## SECTION 801 LANDSCAPE EXCAVATION:

### 801-1 Description:

The work under this section shall consist of excavating areas to be landscaped, hauling, and satisfactory disposal of surplus excavated material, in accordance with the details shown on the project plans and the requirements of these specifications.

### 801-2 Blank

### 801-3 Construction Requirements:

All landscape excavation shall be performed in reasonably close conformity to the lines, grades, dimensions and cross sections established by the Engineer or shown on the project plans.

The hauling and disposal of surplus excavated material shall be in accordance with the requirements of Subsection 203-3.03(E).

### 801-4 Method of Measurement:

Landscape excavation will be measured either by the cubic yard or by the ton.

Landscape excavation measured by the cubic yard will be measured in its original position by the Engineer, and the volume will be computed by the average end area method or by other methods approved by the Engineer.

Landscape excavation measured by the ton will be measured in accordance with the requirements of Subsection 109.01.

### 801-5 Basis of Payment:

The accepted quantities of landscape excavation, measured as provided above, will be paid for at the contract unit price per cubic yard or per ton for the pay unit designated in the bidding schedule.

## SECTION 802 LANDSCAPE GRADING:

### 802-1 Description:

The work under this section shall consist of grading, contouring, smoothing or otherwise shaping areas at the locations designated on the project plans.

### 802-2 Blank

### 802-3 Construction Requirements:

Roadway shoulders and soil areas left exposed after planting shall be graded as required to leave a generally smooth appearance conforming to the general shape and cross section indicated on the project plans. The final surfaces shall be raked smooth. All objectionable material, trash, brush, weeds and stones larger than two inches in diameter shall be removed from the site and disposed of in a manner acceptable to the Engineer.

### 802-4 Method of Measurement:

Landscape grading will be measured either by the square yard of area actually graded or as a single complete unit of work.

### 802-5 Basis of Payment:

The accepted quantities of landscape grading, measured as provided above, will be paid for at the contract unit price per square yard or per lump sum for the pay unit designated in the bidding schedule.

When landscape grading is not included as a contract item, full compensation for any landscape grading necessary to perform the construction operations specified on the project plans and in the Special Provisions will be considered as included in the unit price paid for contract items.

## SECTION 803 LANDSCAPE PLATING MATERIALS:

### 803-1 Description:

The work under this section shall consist of grading surfaces, eradicating grasses, weeds and undesirable vegetation, furnishing, hauling, placing and compacting imported materials for plating embankment slopes, dikes and other designated areas, all in accordance with the details shown on the project plans and the requirements of these specifications.

### 803-2 Materials:

### 803-2.01 Soil Backfill and Plating Material:

Soil backfill and plating material shall be secured from commercial sources or from contractor furnished sources unless otherwise designated in the Special Provisions. The material shall conform to the requirements of Subsection 804-2.

### 803-2.02 Decomposed Granite and Granite Mulch:

Decomposed granite and granite mulch shall be free of lumps or balls of clay and shall not contain calcareous coatings, caliche, organic matter or foreign substances. All material shall be from a single production source and shall present a uniform appearance throughout the project. The gradation of the decomposed granite shall be as specified in the Special Provisions.

**803-2.03 Rock Mulch:**

Rock mulch shall be free of calcareous coating, caliche, organic matter or other foreign substances.

**803-3 Construction Requirements:**

**803-3.01 Soil Backfill and Plating Material:**

Areas to receive soil backfill and plating material shall be cleared of all undesirable vegetation, brush, trash, or rock which is two inches in diameter or larger, and other objectionable material as directed by the Engineer. Undesirable vegetation, grasses and weeds shall be eradicated with an approved herbicide and by mechanical methods.

The soil backfill and plating material shall be spread and shaped to conform to the lines, grades and cross sections shown on the project plans or as established by the Engineer. The material shall be watered and compacted as specified in the Special Provisions.

**803-3.02 Decomposed Granite and Granite Mulch:**

Decomposed granite or granite mulch shall not be placed until the required water distribution systems, acceptable finished grading, and planting operations have been completed within the area.

The surfaces and planting areas upon which decomposed granite or granite mulch is to be placed shall be graded and compacted to a density of 85 percent of the maximum density as determined in accordance with the requirements of the applicable test methods of the ADOT Materials Testing Manual, as directed and approved by the Engineer. Areas which shall not be compacted will be designated by the Engineer.

The areas on which decomposed granite or granite mulch is to be placed shall be reasonably smooth and firm and all deleterious material and rocks larger than 1-1/4 inches in diameter shall be removed and disposed of by the contractor.

Decomposed granite or granite mulch shall be evenly distributed over the designated areas. The depth of the decomposed granite or granite mulch shall be within 1/2 inch of the depth shown on the project plans. All areas to receive decomposed granite or granite mulch shall be as approved by the Engineer prior to placement of the decomposed granite or granite mulch.

All vehicles used for spreading, grading, and raking the granite mulch and decomposed granite shall have one set of wheels with floatation tires having a minimum width of 18 inches to allow equal compaction of the granite mulch and decomposed granite.

After rough spreading and rough grading of the granite mulch and decomposed granite within the designated areas, the granite mulch and decomposed granite shall be raked to evenly blend the different gradation sizes. Following approval by the Engineer, the granite mulch and decomposed granite shall be saturated with water to optimum moisture level.

The Engineer will approve the amount of water necessary to aid in the compaction of the granite mulch and decomposed granite.

Where granite mulch and decomposed granite are within the planting pits, the maximum depth shall be one inch.

During the final spreading and final grading operations, all surfaces within the granite mulch and decomposed granite areas shall be passed over by the spreading and grading equipment a minimum of two times. All equipment operations for spreading and grading, raking, chemical application, water settling, and any other operations shall be done in a manner that uniformly maximizes the vehicles' wheel compaction over the surface.

The contractor shall apply one application of an approved pre-emergent herbicide on all granite areas following placement of the granite. Water to activate the pre-emergent herbicide shall be applied to the areas of the herbicide application as recommended by the manufacturer's label. This water may be supplemented by rainfall as determined by the Engineer.

The contractor shall notify the Engineer and obtain prior approval for the use of any herbicides for weed eradication. The contractor shall keep a record of all applications; the type of herbicides used; the rate and method of application; and the date and location of such applications. A copy of this record shall be submitted to the Engineer after each application.

After placing, spreading and grading the granite, the contractor shall water settle the total thickness of the granite to remove the fine material from the surface.

Any erosion which occurs within the decomposed granite and granite mulch areas shall be corrected by the contractor and approved by the Engineer prior to final acceptance.

**803-3.03 Rock Mulch:**

The surfaces upon which the rock mulch is to be placed shall be fine graded and compacted to 90 percent of the maximum density as determined in accordance with the requirements of the applicable test methods of the ADOT Materials Testing Manual, as directed and approved by the Engineer. All deleterious material shall be removed and disposed of by the contractor. The areas shall be totally free of grasses, weeds and undesirable vegetation, using herbicides in accordance with Subsection 803-3.02. All dead grass and weeds shall be removed and disposed of by the contractor as approved by the Engineer. The contractor shall repair eroded areas and compact soil as approved by the Engineer.

Prior to placement of rock mulch, the contractor shall stake out all areas to receive rock mulch and a pre-emergent herbicide shall be applied to the staked areas in accordance with the manufacturer's printed instructions and as approved by the Engineer. Water shall be applied to the areas of the herbicide application as required by the manufacturer's label. This water may be supplemented by rainfall as determined by the Engineer.

The rock shall be placed in an even application, tightly packed, to provide complete coverage of the area shown on the project plans so that soil will not be visible between rocks.

After placing and grading the rock mulch, the contractor shall water the mulch with a light spray to remove fine material from the surface as approved by the Engineer. Any regrading that is necessary after placement of the rock mulch shall be at no additional cost to the Department.

Care shall be taken in the placement of the rock mulch so as not to disturb or damage any plant material, adjacent surfaces or irrigation equipment.

**803-4 Method of Measurement:**

Decomposed granite and granite mulch will be measured by the square yard, or by the cubic yard, of material in place at the specified thickness. The quantity for this item, as shown on the bidding schedule, will be used for payment of this item unless the contractor and the Engineer agree that there is a variation in excess of 10 percent. The Engineer will determine the new quantities for variations in excess of 10 percent.

Rock mulch will be measured by the cubic yard of material in place at the specified thickness. The quantity for this item, as shown on the bidding schedule, will be used for payment of this item unless the contractor and the Engineer agree that there is a variation in excess of 10 percent. The Engineer will determine the new quantities for variations in excess of 10 percent.

Soil backfill and plating material (landscape borrow) will be measured either by the cubic yard or by the ton.

Soil backfill and plating material (landscape borrow) measured by the cubic yard will be measured in its original position by the Engineer, and the volume will be computed by the average end area method or by other methods approved by the Engineer.

Soil backfill and plating material (landscape borrow) measured by the ton will be measured in accordance with the requirements of Subsection 109.01. The weight of the material will be determined by deducting the difference in weight between the average in-place moisture content of the material prior to any prewetting in accordance with the requirements of Subsection 206-3 and the average moisture content of the material at the time of weighing.

**803-5 Basis of Payment:**

The accepted quantities of landscape borrow, decomposed granite, granite mulch and rock mulch, measured as provided above, complete in place, will be paid for at the contract unit price for the pay unit designated in the bidding schedule. No direct payment will be made for the eradication of grasses, weeds and undesirable vegetation; herbicide material applied in excess of the specified thickness; or erosion repair work; the cost being considered as part of contract items.

## SECTION 804 TOPSOIL:

### 804-1 Description:

The work under this section shall consist of furnishing, hauling and placing topsoil in accordance with the details shown on the project plans and the requirements of these specifications.

### 804-2 Materials:

When a source of topsoil is not designated, the contractor shall furnish a source in accordance with the requirements of Section 1001. Topsoil from sources furnished by the contractor shall conform to the following requirements:

Prior to hauling any topsoil to the project site, the contractor shall furnish a written soil analysis, prepared by a laboratory approved by the Engineer, for each source of topsoil proposed for use. The soil analysis shall indicate the pH, soluble salts, percent calcium carbonate, exchangeable sodium in percent and parts per million, plasticity index and size gradation. A minimum of three samples per each 10,000 cubic yards, with at least three samples per source, shall be tested. All tests shall be performed in accordance with the following requirements and test procedures listed in Table 804-1. At the contractor's option, the Engineer will test these topsoil samples. The contractor shall bear the expense of any topsoil testing from proposed sources.

Topsoil shall be fertile, friable soil obtained from well drained arable land which has or is producing healthy crops, grasses or other vegetation. It shall be free draining, non-toxic and capable of sustaining healthy plant growth.

Topsoil shall be reasonably free of subsoil, refuse, roots, heavy clay, clods, noxious weed seeds, phytotoxic materials, coarse sand, large rocks, sticks, brush, litter and other deleterious substances.

A written soil analysis shall be submitted to the Engineer for each source of topsoil proposed for use. The Engineer's approval shall be obtained prior to delivery of topsoil to the project site from each source.

For acceptance purposes, each approximate 20,000 cubic yards of topsoil material delivered from a given source to the project site shall be considered a lot. For each lot of topsoil, six representative samples shall be taken at random locations designated by the Engineer. Topsoil shall be sampled after final placement. Each source of topsoil shall be tested separately. The samples from each lot shall be tested by the Engineer for pH, soluble salts, calcium carbonate, exchangeable sodium in percentage and parts per million, P.I., and gradation in accordance with the test procedures listed in Table 804-1.

The average test result obtained for each characteristic from each lot shall meet the following requirements.

| TABLE 804-1 | | |
|---|---|---|
| **Characteristics** | **Test Method** | **Requirement Average of 6 Samples** |
| pH | ARIZ 237 | 6.0 - 8.3 |
| Soluble Salts: (PPM) | ARIZ 237 | 2000 Maximum |
| Calcium Carbonate: | ARIZ 732 | 8% Maximum |
| Exchangeable Sodium: | ARIZ 729 | 5% Maximum |
| Exchangeable Sodium: (PPM) | ARIZ 729 | 300 Maximum |
| P.I. | AASHTO T 90 | 5 - 20 |
| Gradation:<br>2 inch<br>1/2 inch<br>No. 40 | ARIZ 201 | % Passing<br>100<br>85 - 100<br>35 - 100 |

If the average test result for a lot fails to meet all the specifications listed above, the material from that lot shall be rejected. In lieu of removal and replacement, the contractor may propose for the Engineer's consideration a method of treatment of the in-place material to obtain specification compliance. Provided the Engineer approves, the topsoil shall be treated at no additional cost to the Department. The lot shall then be resampled and tested for specification compliance by the Engineer.

If the pH of the topsoil for a lot exceeds 8.3, the topsoil shall either be removed and replaced, or be treated as provided for in the preceding paragraph. Any treatment for pH shall be sufficient to obtain an average pH between 6.0 and 8.0, inclusive. The treatment for pH shall follow the recommendations of a recognized soil analyst and shall be subject to the approval of the Engineer. Any treatment for pH shall be at no additional cost to the Department. Additional acceptance testing after treatment for pH will not be required.

**804-3 Construction Requirements:**

Topsoil shall be spread uniformly on the designated areas to the depths or contours shown on the plans. The contractor shall avoid over-compaction in spreading and shaping operations. Scarification shall be required for over-compacted areas and haul roads. When topsoil is placed over subgrade material as plating, the subgrade shall be scarified or disked to a six-inch depth prior to placement of the topsoil.

**804-4 Method of Measurement:**

Topsoil will be measured by the cubic yard.

Topsoil will be measured in its final position, and the volume will be computed by the average end area method or by other methods approved by the Engineer.

**804-5 Basis of Payment:**

The accepted quantities of topsoil, measured as provided above, will be paid for at the contract unit price per cubic yard, complete in place.

## SECTION 805 SEEDING:

### 805-1 Description:

The work under this section shall consist of furnishing all materials, preparing the soil and applying seed to all areas designated on the project plans or established by the Engineer. Seeding shall be Class I, Class II or Class III, and shall be performed in accordance with the project plans and requirements of these specifications.

### 805-2 Materials:

### 805-2.01 General:

Certificates of Compliance conforming to the requirements of Subsection 106.05 shall be submitted.

### 805-2.02 Seed:

The species, strain or origin of seed shall be as designated in the Special Provisions.

No substitution of species, strain or origin of seed will be allowed unless evidence is submitted in writing by the contractor to the Engineer showing that the specified materials are not reasonably available during the contract period. The substitution of species, strains or origins shall be made only with the written approval of the Engineer, prior to making said substitution.

The seed shall be delivered to the project site in standard, sealed, undamaged containers. Each container shall be labeled in accordance with Arizona Revised Statues and the U.S. Department of Agriculture rules and regulations under the Federal Seed Act. Labels shall indicate the variety or strain of seed, the percentage of germination, purity and weed content, and the date of analysis which shall not be more than nine months prior to the delivery date.

Legume seed shall be inoculated with appropriate bacteria cultures approved by the Engineer, in accordance with the culture manufacturers' instructions.

### 805-2.03 Mulch:

#### (A) General:

The type and application rate of mulch shall be as specified in the Special Provisions.

#### (B) Manure:

Manure shall be steer manure that has been well composted and unleached, and which has been collected from cattle feeder operations. Manure shall be free of sticks, stones, earth,

weed seed, substances injurious or toxic to plant growth and visible amounts of undercomposted straw or bedding material. Manure shall not contain lumps or any foreign substance that will not pass a 1/2-inch screen and, when specified for lawn use, the material shall be ground or screened so as to pass a 1/4-inch screen.

**(C) Peat Humus:**

Peat humus shall be natural domestic peat of peat humus from fresh water saturated areas, consisting of sedge, sphagnum or reed peat and shall be of such physical condition that it will pass through a 1/2-inch screen. The humus shall be free of sticks, stones, roots and other objectionable materials.

Peat humus shall have a pH value between 4.0 and 7.5, inclusive, and the minimum organic content shall be 85 percent of the dry weight. The ash content, as determined by igniting a five gram sample for 20 hours at a temperature of 900 degrees F, shall not exceed 25 percent by weight.

Peat humus shall be furnished in undamaged commercial bales in an air-dry condition.

**(D) Wood Cellulose Fibers:**

Natural wood cellulose fiber shall have the property of dispersing readily in water and shall have no toxic effect when combined with seed or other materials. A colored dye which is noninjurious to plant growth may be used. Wood cellulose fiber shall be delivered in undamaged, labeled containers bearing the name of the manufacturer and showing the air-dry water content.

**(E) Straw:**

Straw shall be from oats, wheat, rye or other grain crops of current season as approved by the Engineer and shall be free of noxious weeds, mold or other objectionable material. Straw mulch shall be from the current season's crop and shall be in an air-dry condition and suitable for placing with mulch blower equipment.

**805-2.04 Water:**

Water shall be free of oil, acid, salts or other substances which are harmful to plants. The source shall be as approved by the Engineer prior to use.

**805-2.05 Tacking Agent:**

Tacking agent shall be as specified in the Special Provisions.

**805-2.06 Chemical Fertilizer:**

Chemical fertilizer shall be a standard commercial fertilizer conforming to the analysis and in the physical form specified in the Special Provisions. Chemical fertilizer shall be furnished in standard containers with the name, weight and guaranteed analysis of the

contents clearly marked. When a mixed fertilizer is specified, such as 5-10-5, the first number shall represent the minimum percent of soluble nitrogen, the second number shall represent the minimum percent of available phosphoric acid and the third number shall represent the minimum percent of water soluble potash.

**805-3 Construction Requirements:**

**805-3.01 General:**

Seed shall be of the class and variety specified, and shall be applied at the rate specified in the Special Provisions.

The contractor shall notify the Engineer at least two days prior to commencing seeding operations.

Bermuda seed shall be planted only at times when the daytime atmospheric temperatures are consistently above 90 degrees F and the nighttime atmospheric temperatures are consistently above 60 degrees F.

Seeding operations shall not be performed when wind would prevent uniform application of materials or would carry seeding materials into areas not designated to be seeded.

Preparation of areas for seeding shall be as specified herein and in the Special Provisions.

The equipment and methods used to distribute seeding materials shall be such as to provide an even and uniform application of seed, mulch and/or other materials at the specified rates.

Unless specified otherwise in the Special Provisions, seeding operations shall not be performed on undisturbed soil outside the clearing and grubbing limits of the project or on steep rock cuts.

**805-3.02 Classes of Seeding:**

**(A) Seeding (Class I):**

Seeding (Class I) shall consist of furnishing and planting lawn seed.

Immediately before seeding, the surface area shall be raked or otherwise loosened to obtain a smooth friable surface free of earth clods, humps and depressions. Loose stones having a dimension greater than one inch and debris brought to the surface during cultivation shall be removed and disposed of by the contractor in a manner approved by the Engineer.

Where indicated on the project plans or specified in the Special Provisions, topsoil shall be placed and allowed to settle for at least one week prior to seeding. The topsoil shall be thoroughly watered at least twice during the settlement period.

Seed shall be uniformly applied in two directions at right angles to each other with one-half the specified application rate applied in each direction.

Immediately after seeding, the area shall be uniformly covered with screened manure at the rate of one cubic yard per 1,000 square feet and then watered until the ground is wet to a minimum depth of two inches.

Hydroseeding (hydraulic seeding), using 1,500 pounds of wood cellulose fiber per acre, will be an acceptable alternate for planting and mulching Seeding (Class I).

Machines used for hydroseeding shall be approved types capable of continuous agitation of the slurry mixture during the seeding operation. Pump pressure shall be such as to maintain a continuous nonfluctuating spray capable of reaching the extremities of the seeding area with the pump unit located on the roadbed. The sprayer shall be equipped to use the proper type of nozzles to obtain a uniform application on the various slopes at the distance to be covered.

The seed, fertilizer, mulch, tacking agent (when required) and water shall be combined in the proportions of the various materials as provided in the Special Provisions and allowed to mix a minimum of five minutes prior to starting the application of the slurry. Seed shall be applied within 30 minutes after mixing with water.

Hydroseeding which is deposited on adjacent trees and shrubs, roadways, in drain ditches, on structures and upon any areas where seeding is not specified or which is placed in excessive depths on seeding areas shall be removed.

Seeding areas flooded or eroded as a result of irrigation shall be repaired, reseeded and refertilized by the contractor, at no expense to the Department.

**(B) Seeding (Class II):**

Seeding (Class II) shall consist of furnishing and planting range grass seed, flower seed and/or shrub seed, including mulch.

Where equipment can operate, the area to be seeded shall be prepared by disking, harrowing or by other approved methods of loosening the surface soil to the depth specified in the Special Provisions. On slopes too steep for equipment to operate, the area shall be prepared by hand raking to the specified depth. On sloping areas, all disking, harrowing and raking shall be directional along the contours of the areas involved. Loose stones having a dimension greater than four inches which are brought to the surface during cultivation shall be removed and disposed of in an approved manner prior to grading and seeding. All areas which are eroded shall be restored to the specified condition, grade and slope as directed prior to seeding.

On cut and fill slopes the operations shall be conducted in such a manner as to form minor ridges thereon to assist in retarding erosion and favor germination of the seed.

Care shall be taken during the seeding operations to prevent damage to existing trees and shrubs in the seeding area in accordance with the requirements of Subsection 107.11. Seed shall be drilled, broadcast or otherwise planted in the manner and at the rate specified in the Special Provisions.

The type of mulch, and the manner and rate of application shall be as specified in the Special Provisions.

Mulch material which is placed upon trees and shrubs, roadways, structures and upon any areas where mulching is not specified or which is placed in excessive depths on mulching areas shall be removed as directed. Mulch materials which are deposited in a matted condition shall be loosened and uniformly spread, to the specified depth, over the mulching areas.

During seeding and mulching operations, care shall be exercised to prevent drift and displacement of materials. Any unevenness in materials shall be immediately corrected by the contractor.

Mulch shall be immediately affixed by crimping and tacking after application. The Engineer shall determine which areas are not conducive to anchoring by crimping and will direct the contractor to anchor such mulch by tacking only. No mulch shall be applied to seeding areas which can not be crimped and/or tacked by the end of each day. Any drifting or displacement of mulch before crimping and/or tacking shall be corrected by the contractor, at no additional cost to the Department.

If a tacking agent is specified in order to bind the mulch in place, the type, rate and manner of application shall be as specified in the Special Provisions. Prior to the application of a tacking agent, protective covering shall be placed on all structures and objects where stains would be objectionable. All necessary precautions shall be taken to protect the traveling public and vehicles from damage due to drifting spray.

Unless otherwise specified in the Special Provisions, Class II seeding areas shall not be watered after planting.

**(C) Seeding (Class III):**

Seeding (Class III) shall consist of furnishing and planting range grass seed, flower seed and/or shrub seed, all without mulching.

Seeding (Class III) shall conform to the requirements specified under Subsection 805-3.02(B), except that mulching will not be required.

Unless otherwise specified in the Special Provisions, Class III seeded areas shall not be watered after planting.

**805-3.03 Preservation of Seeded Areas:**

The contractor shall protect seeded areas from damage by traffic or construction equipment. Surfaces which are eroded or otherwise damaged following seeding and prior to final acceptance shall be repaired by regrading, reseeding and remulching as directed by the Engineer.

**805-4 Method of Measurement:**

Seeding (Class I) will be measured by the square foot of ground surface measured to the nearest 1,000 square feet seeded or as a single complete unit of work.

Seeding (Class II) and Seeding (Class III) will be measured by the acre of ground surface seeded or as a single complete unit of work.

**805-5 Basis of Payment:**

The accepted quantities of seeding, measured as provided above, will be paid for at the contract price for the pay unit specified in the bidding schedule, complete in place.

No direct measurement or payment will be made for the preservation or repairs of seeded areas.

## SECTION 806 TREES, SHRUBS AND PLANTS:

**806-1 Description:**

The work under this section shall consist of furnishing and planting trees, palms, shrubs, vines, cacti and other plants (nursery stock) and transplanting trees, palms, shrubs, vines, cacti and other plants (collected stock and/or local stock), all as designated on the project plans. The work shall also include the layout and preparation of planting pits, trenches and beds, including excavating and backfilling; the storage and protection of all planted and unplanted stock and other materials; amendments, all mulching, fertilizing, watering, staking, guying, pruning and wrapping; the cleanup of the area; application of pre-emergent herbicide; removal of grass, weed and undesirable vegetation; application of rodent repellent; disposal of unwanted and deleterious materials; and the care and maintenance; all in accordance with the details shown on the project plans and the requirements of these specifications.

**806-2 Materials:**

Certificates of Compliance conforming to the requirements of Subsection 106.05 shall be submitted to the Engineer for all contractor furnished materials, unless otherwise specified.

**806-2.01 Nursery Stock:**

All plants shall be grown in a nursery and shall conform to the applicable requirements specified in the current edition of "American Standard for Nursery Stock" as approved by the American National Standards Institute, Inc., and sponsored by the American

Association of Nurserymen, Inc., subject to certain variations in size and measurement when specified on the project plans or in the Special Provisions.

Botanical plant names shall be in accordance with the current edition of "Standardized Plant Names" prepared by the American Joint Committee on Horticultural Nomenclature.

All plants shall be true to type and species shown on the project plans and at least one plant in each group of plants of the same species delivered to the project shall be tagged with a weatherproof label stating both the botanical and common name of the plants in that group.

Within thirty calendar days after the preconstruction conference, the contractor shall supply the Engineer with written verification that it has located and reserved all the plant material necessary to complete the work as specified. This verification will serve as proof of availability for all plant material required.

All plants shall be in a healthy condition with normal symmetrical form, well-developed foliage, branches and cane systems at the time of delivery to the project. Plants shall be free of disease, insect eggs or infestations, disfiguring knots, bark abrasions, broken tops, branches or canes, damaged roots, sun, wind or frost injury, or other objectionable features. Plants pruned from larger sizes to meet specified sizes will not be accepted.

Plants which are furnished in containers shall have been growing in the containers for a sufficient period of time for uniform root development throughout the plants' ball, but the roots shall show no evidence of having been restricted or deformed.

The presence of grass, weeds, or any undesirable organism in the soil surrounding the plants, or any of the previously listed conditions, may be cause for rejection of the plants.

No substitution of species and/or sizes of specified plants shall be made unless evidence is submitted in writing to the Engineer showing that plants in the species, quantity and/or sizes specified are not available during the contract period. The substitution of species and/or sizes shall be made only with the written approval of the Engineer prior to making said substitution.

Substitution of a larger size of the same species may be made by the contractor without written approval. However, the contractor shall be responsible for any additional cost of the plants or for any additional planting costs.

All plants shall comply with Federal and State laws requiring inspection for diseases and infestations.

All shipments or deliveries of plant material grown within the State will be inspected at the nursery or growing site by the authorized State of Arizona authorities prior to delivery to the project. A copy of the state inspection record shall accompany all plant material which is grown out of state and shall show that the plant material has been inspected for plant diseases and insects.

All rejected plants shall be removed from the project immediately upon rejection by the Engineer.

**806-2.02 Collected Stock:**

Collected stock shall be secured from sources outside the project limits for transplanting, and shall comply with the size, type and species requirements designated on the project plans or in the Special Provisions. When sources for collected stock are not designated, the contractor shall furnish the source.

Collected stock shall be healthy and free of weeds, grasses, insects, disease, defects and disfigurements, and shall be as approved by the Engineer before transplanting operations are begun. Palm trees shall be free of scars and damage considered unsightly or unhealthy as determined by the Engineer.

The contractor shall comply with all State and Federal laws regarding the removal, sale and transporting of native plants.

**806-2.03 Local Stock:**

Local stock shall be secured from within the project limits for transplanting and will be designated on the project plans, in the Special Provisions or by the Engineer. All plants shall be as approved by the Engineer before transplanting operations are begun.

**806-2.04 Prepared Topsoil:**

Prepared topsoil shall consist of prepared soil mixed as specified under Subsection 806-2.05, Prepared Soil, except the existing soil shall be replaced with topsoil. The existing soil excavated from the planting pits shall be removed and disposed of by the contractor. Soil conditioner shall be as specified under Subsection 806-2.05.

Topsoil shall conform to the requirements of Subsection 804-2. Soil excavated from existing planting pits, trenches and beds which meet the requirements of Subsection 804-2 may be used as topsoil.

**806-2.05 Prepared Soil:**

Prepared soil shall consist of a uniform mixture of existing soil, peat humus, manure, chemical fertilizer, soil conditioners and/or other needed amendments conforming to the specifications contained herein for the respective items and proportioned as specified in the Special Provisions.

Soil conditioner shall consist of composted, ground or shredded fir, redwood, ponderosa bark or shavings, and shall have a pH not exceeding 7.5, a minimum total nitrogen content of 0.5 percent, an organic matter content of not less than 85 percent, and shall contain a wetting agent or be hygroscopic. The soil conditioner shall be graded so that a minimum of 85 percent of the material will pass a 1/4-inch sieve.

Prepared soil shall be produced prior to use in the planting pits, by combining the approved component materials into a homogeneous uniform mixture. The Engineer shall be notified and shall approve the components and the method of mixing prior to the production of the prepared soil.

**806-2.06 Mulch:**

Mulch shall conform to the requirements of Subsection 805-2.03.

**806-2.07 Water:**

Water shall conform to the requirements of Subsection 805-2.04.

**806-2.08 Chemical Fertilizer:**

Chemical fertilizer shall conform to the requirements of Subsection 805-2.06.

**806-2.09 Lumber and Tree-Stakes:**

Tree-stakes, supports and braces shall be sound, straight construction grade treated Douglas fir, lodge pole pine, heart redwood or other species approved by the Engineer. Douglas fir stakes and braces shall have nominal dimensions of two by two inches and lodge pole pine stakes shall have a diameter of two inches or greater. Tree-stakes and braces may be furnished either rough or dressed.

Lumber stored at the project site shall be neatly stacked on skids a minimum of 12 inches above the ground and shall be protected from the elements to prevent damage or warping.

**806-2.10 Hardware:**

Nails, lag screws, staples and other hardware shall be galvanized and of commercial quality. All bolts and lag screws shall be furnished with galvanized malleable washers.

Wire shall be new soft annealed galvanized steel wire of the size detailed on the project plans.

Covers for guying wires shall be new, 1/2-inch minimum diameter, vinyl or two-ply fabric-bearing rubber hose.

**806-2.11 Existing Plant Material:**

The contractor shall be responsible for maintaining all existing plants and providing an adequate water supply to any existing plants affected by construction activities. Existing plants that are removed, damaged or destroyed during construction shall be replaced with trees and shrubs of the same species at no additional cost to the Department. Existing plants removed, damaged, or destroyed shall be replaced with plants of a similar size as directed by the Engineer.

## 806-3 Construction Requirements:

### 806-3.01 General:

At the time of the preconstruction conference, the contractor shall submit to the Engineer seven copies of a list of all materials and equipment that it proposes to incorporate into the work. The contractor shall have materials and equipment correctly marked on each copy of the list. The list shall show the catalog number, manufacturer's name, model numbers, sizes, complete specifications, instructions, design data and/or drawings, to determine whether or not each piece of material or equipment is acceptable and to assure that all such materials and equipment, when incorporated into the work, will be in accordance with the requirements of the project plans and these specifications. Plant material shall be approved as specified under Subsection 806-3.03. The contractor's failure to comply with these material submittal instructions will not constitute time extensions.

No material or equipment shall be ordered and work shall not begin until the material and equipment has been approved, in writing, by the Engineer.

All planting shall be done during the times and/or temperatures specified in the Special Provisions.

### 806-3.02 Excavation:

The contractor shall be responsible for laying out all planting areas and staking all plant locations in reasonably close conformity to the dimensions and locations shown on the project plans. The Engineer's approval of all planting areas and locations shall be obtained prior to any excavating of planting pits, trenches or beds.

In the event that existing field conditions such as subsurface utilities, pipes, structures, impervious materials or inadequate drainage necessitate relocation of planting areas, the Engineer will designate new locations.

Prior to excavating planting pits or trenches or beds for plants, these areas shall be graded to the lines and grades designated on the project plans or as approved by the Engineer.

Planting pits and trenches shall be excavated to the dimensions indicated on the project plans or in the Special Provisions and shall have vertical sides and horizontal bottoms. When dimensions are not specified, the pits and trenches shall be excavated to a depth 12 inches below the bottom of the root system and to a width twice the root system diameter.

When excavation of any planting pit is difficult and the Engineer determines that poor drainage may result, the pit shall be filled with water twice in order to check the drainage. Any pit which has not fully drained after each filling within a twelve hour period shall be deepened until proper drainage is achieved. If proper drainage cannot be achieved, the pit shall be moved or deleted, as determined by the Engineer. If required, this work shall be paid for in accordance with Subsection 104.02.

Excavation of planting pits, trenches and beds shall not be done when, in the opinion of the Engineer, the moisture content of the soil is excessive with respect to accepted horticultural practice.

**806-3.03 Shipping and Handling Plants:**

Prior to shipping, all plants shall be dug, handled, prepared and packed for shipment with care and skill, in accordance with recognized standard practice for the kind of plant involved. The root systems of all plants shall not be permitted to dry out at any time. While in transit, plants shall be protected at all times against freezing temperatures, the sun, the wind and other adverse weather conditions. During transportation in closed vehicles, plants shall receive adequate ventilation to prevent "sweating." Plants delivered in a wilted condition will be rejected.

The contractor shall notify the Engineer at least 24 hours prior to the date for inspection of plants at any Arizona plant source or at the project site. The Engineer will inspect all plants for conformity with the specifications and, upon the Engineer's acceptance, planting may begin. The Engineer may select at random no more than three container-grown plants of each species in every delivery to the site for root development inspection. Plants of the same species from different growers shall be considered as separate shipments. If upon inspection of root development of plants so selected the Engineer determines the roots have become restricted or deformed in their containers, all plants of that species in that shipment, including the inspected plants, will be rejected and shall be removed from the site. The contractor's project supervisor shall attend all plant inspections.

Deciduous plants may be furnished bare-root, and evergreen plants and conifers shall be furnished balled and burlapped or in containers, as specified in the Special Provisions or on the project plans. The balling and burlapping of trees and shrubs shall conform to the recommended specifications set forth in the "American Standard for Nursery Stock." All plant balls shall be firm and intact. Plants whose stems are loose in the ball will be rejected. All balled or burlapped plants shall at all times be handled by the ball and not by the top, leaders or canes.

All bare-root plants delivered in bundles shall have the bundles broken and the plants placed separately prior to being temporarily "heeled-in." Care shall be taken so that all plants removed from bundles will have an identifying label. Bare-root plants shall be stored with roots completely covered with damp sawdust, soil or other suitable moisture-retaining material.

Plants delivered, inspected and found acceptable for planting shall normally be planted within 24 hours after delivery to the project site. Plants which cannot be planted within 24 hours after delivery shall be stored as specified herein.

Balled and burlapped plants shall have the root ball protected by moist sawdust, earth or other acceptable material.

All temporarily stored plants shall be protected from extreme weather conditions and the roots shall be kept moist.

**806-3.04 Planting:**

**(A) General:**

On landscaping projects with irrigation systems, no planting shall be done until installation and acceptance of the irrigation system in total or in increments. The initial watering and all subsequent watering of the planting shall be done using the newly constructed irrigation system. The plant material may need temporary irrigation systems acceptable to the Engineer for the initial watering of large plant material over and above the designed irrigation system.

**(B) Nursery Stock:**

After the planting pits are refilled with amended soil, and the irrigation system has been installed and accepted, the planting pits shall be pre-watered by the irrigation system for a minimum duration of twelve hours. Planting shall be accomplished during a three-day period starting two days following the prewetting as specified. Areas not planted during the three-day period shall be re-watered and allowed to dry as specified above.

Planting shall not be done in soil that is excessively moist or otherwise in a condition not satisfactory for planting in accordance with accepted horticultural practice.

Plants which are in containers, bare root, or balled and burlapped shall be planted and watered the same day the container, wrap, or moisture protection is cut.

The contractor shall adequately water plants to maintain a healthy and vigorous growing condition during the planting period.

Plants shall be removed from containers such that the root ball is not broken. Plants with broken root balls or with root balls that fall apart while being planted will be rejected.

Plants shall be planted plumb and shall be centered in the planting pit or trench. All planting pits shall have vertical sides and flat bottoms.

Backfill material shall be prepared soil conforming to the requirements of Subsection 806-2.05 or prepared topsoil conforming to the requirements of Subsection 806-2.04. Backfill shall be carefully firmed around the roots or the ball of the plant so as to eliminate all air pockets and shall not be compacted around the roots or ball of the plants during or after planting operations.

Clods or stones exceeding two inches in diameter and foreign matter deemed objectionable by the Engineer will not be allowed. All excess soil that has objectionable stones shall be disposed of off the project site in a manner acceptable to the Engineer. No additional payment will be made for the removal and disposal of objectionable stone, or soil containing foreign matter.

Any excess soil which is not used to backfill the planting pits may be evenly distributed in the landscape areas if it will not interfere with the final grading of any landscape areas. All planting areas shall be graded as specified to facilitate proper watering of all material, and leave a generally smooth appearance after completion of planting.

Plants shall be set to a depth such that, after backfilling and watering, the top of the root ball and the level of the backfill will match the surrounding grade as shown on the project plans. Any plant that settles more than 1-1/2 inches below the specified grade shall be reset or replaced. Any additional backfill material required shall be as specified in the Special Provisions and on the project plans.

Immediately after planting, all plants shall be thoroughly irrigated until the backfill soil around and below the roots or the root ball of each plant is saturated.

**(C) Collected Stock and Local Stock:**

If slings or cables are used to support stock during transporting and planting, the plant trunk shall be protected at the points of contact with slings and cables with burlap, canvas, sections of automobile tire casing, or other suitable protective material. Cables shall be placed to maintain proper support and balance at all times.

A tree spade may be used for digging and moving the stock. A thin layer of soil conditioner shall be placed in the planting hole before planting the stock with a tree spade.

Dead fronds, certain live fronds, flower stalks and seed pods shall be removed from palm trees, leaving a minimum crown of six to eight tiers of live fronds on each tree. Crown fronds shall be pulled together and loosely, but securely, tied in an upward position to protect the heart of the tree. Fronds shall be tied with light manila rope or multiple strands of binder twine. Frond ties shall remain in place for a minimum of 60 days after planting.

The contractor shall be responsible for preventing damage or death of the stock during moving operations and after planting is completed. Damaged stock shall be replaced with stock of the same species and of equal size.

After planting, the contractor shall maintain all collected stock and local stock in established positions during construction and landscaping establishment periods.

The contractor shall ensure that palms have been chemically sprayed with an approved preventative treatment to inhibit development of bud rot during the planting operation and during periods of high humidity and warm temperatures. The treatment shall be applied to allow deep penetration into the palm tree hearts.

Care shall be taken such that no palm tree is dropped or mishandled during the planting operations. Bending the palm tree trunk or causing uneven contact of the tree trunk with another surface may damage the palm tree heart and eventually kill the tree.

**806-3.05 Pruning and Staking:**

All plants shall be pruned in accordance with accepted horticultural practices. All dead and damaged twigs and branches shall be removed in order to form each type of plant to the standard shape for its species.

Trees shall be supported as shown on the project plans or as specified in the Special Provisions.

Tree-stakes shall be driven vertically at least six inches into firm, undisturbed ground at the bottom of the planting pit or trench. Stakes shall be positioned to clear the root system without disturbing the integrity of the roots.

Guying shall be as shown on the project plans or as directed by the Engineer.

Tree ties and guy wires shall be periodically inspected and adjusted as necessary to prevent "girdling" or injury to tree trunks or branches.

Trees shall be secured to the stakes with tree ties, after backfilling and prior to irrigating, as shown on the project plans and/or as specified in the Special Provisions.

**806-3.06 Care and Protection of Trees, Shrubs and Plants:**

Prior to beginning work under Section 807, the contractor shall be responsible for maintaining and protecting all planting areas, as specified in Subsection 807-3.02, including the care and protection of trees, shrubs and plants planted under this section. Such care and protection shall include, but not be limited to, the watering of stock; removal of construction trash and debris; eradicating and removing all weeds and undesirable vegetation as specified in the Special Provisions; repairing, adjusting or replacing stakes and guying; repairing weather damage or damage caused by the public; furnishing and applying sprays, dust and/or cages to combat vandalism, disease, insects and pests; and taking all precautions necessary to prevent damage from cold, frost, sunburn or other hazards. All existing undesirable grasses and weeds shall be eradicated with herbicides or manual methods during Phase I, and disposed of by the contractor in accordance with Subsection 807-3.02.

The contractor shall remove and replace, at no additional cost to the Department, all dead plants and all plants that show signs of failure to grow or which are injured or damaged so as to render them unsuitable for the purpose intended, as determined by the Engineer. The contractor may, with the approval of the Engineer, delay replacement of plants killed by frost until such time that frost is not imminent.

Plants shall be staked as detailed on the project plans. All wire ties used on plant staking shall be stapled to stakes in a manner acceptable to the Engineer. Staking shall be driven into undisturbed soil below the planting pit bottom as detailed on the project plans. Rubber hoses on tree ties shall be a minimum of six inches in length at each wire loop. All tie wire exposed to tree trunks shall be covered with hose or other material approved by the Engineer.

Any person or persons applying pesticides will be considered as doing so for hire and shall be licensed in accordance with the requirements of Title 3, Chapter 2, Arizona Revised Statutes, Article 6, Section 3-377.

The contractor shall notify the Engineer and obtain prior approval of the use of any chemicals for weed eradication or control. The types of herbicide to be used and the methods of application shall conform to Environmental Protection Agency requirements, the labeling instructions, and shall be as approved by the Engineer. The contractor shall keep a record of all applications, types of herbicide used such as pre- or post-emergent, rates and methods of application, and the dates and locations of such applications on forms supplied by the Engineer. A copy of this record shall be submitted to the Engineer after each application.

Pre-emergent herbicides or manual weed control shall be used on noxious weeds in planting areas located within the project limits; but noxious weed control within granite mulch, decomposed granite or rock mulch shall be as specified under those items of work. All areas shall be kept free of noxious weeds. All planting areas within the project limits shall receive an approved pre-emergent herbicide, as specified under Subsection 803-3.02. The application of herbicide shall include all areas not covered under other items of the specifications.

The contractor shall pay special attention to the infestation of nut and bermuda grasses. Either of these items found in the planting pits of that material shall be grounds for immediate removal, disposal, and replacement of that item. The planting pit shall be excavated and inspected to assure complete eradication of any roots or rhizomes which may have grown into the area. All this work and material shall be the responsibility of the contractor, at no additional cost to the Department.

**806-4 Method of Measurement:**

Planting trees, shrubs and plants, and transplanting trees, shrubs and plants will be measured on a lump sum basis, except that when the bidding schedule sets forth specific items under this section on a unit basis, measurement will be made by the unit for each item designated in the bidding schedule.

**806-5 Basis of Payment:**

The accepted quantities of trees, shrubs and plants, measured as provided above, will be paid for at the contract lump sum price or contract unit price each for the pay unit designated in the bidding schedule, complete in place.

No measurement or direct payment will be made for plants selected for inspection and not planted or for the care and protection of trees, shrubs and plants prior to the beginning of the Landscaping Establishment period, the costs being considered as included in the prices paid for plants accepted and paid for under the various contract bid items.

## SECTION 807 LANDSCAPING ESTABLISHMENT:

## 807-1 Description:

The work under this section shall consist of the care of all stock in accordance with accepted horticultural practices; keeping all areas free of weeds, grasses and construction related debris; applying all irrigation water; repairing, adjusting or replacing stakes and guys; repairing public or weather damage; furnishing and applying sprays, dust and/or cages to combat vandalism, disease, insects and other pests; pruning as required by the Engineer; and the testing, adjusting, repairing and operating of irrigation systems; as shown on the project plans and in accordance with the requirements of these specifications.

## 807-2 Materials:

Materials necessary for the establishment of seeding and planted stock, and the operations of irrigation systems shall be furnished by the contractor and shall conform to the requirements of these specifications and the Special Provisions. The contractor shall notify the Engineer and obtain prior approval for the use of any chemicals for weed control or eradication.

## 807-3 Construction Requirements:

### 807-3.01 General:

The work period for landscaping establishment shall be the number of calendar days specified in the Special Provisions. The work period shall begin after all other work under the contract has been completed and only when the Engineer is assured that the work can be performed in a continuous and consistent manner without restricting the use of any facilities by the traveling public.

Each month the contractor shall submit a work schedule of operations for approval by the Engineer. The work schedule shall show the dates of work to be completed, including the dates of replanting, weed control, pruning, staking and guying, furnishing and applying sprays and dust to combat diseases, insects, and other pests, and irrigation testing or other work required by the Engineer.

Each calendar day during which the Engineer determines that no work under landscaping establishment is required, and the contractor is so advised, regardless of whether or not the contractor performs landscaping establishment work, will be used to reduce the total number of calendar days specified.

Each calendar day during which the Engineer determines that work under landscaping establishment is required, and the contractor is so advised, and the contractor fails to accomplish the required work, will not be used to reduce the total number of calendar days specified.

Thirty calendar days after the beginning of the landscaping establishment period and at the end of each additional 30 calendar days the Engineer, accompanied by the contractor, will inspect all landscaping items, planted stock and irrigation systems. The Engineer will notify

the contractor at least one week in advance of the date for each inspection. The final inspection will be made approximately 21 calendar days prior to the expected termination of the landscaping establishment period.

A special inspection shall be performed at anytime during the landscaping establishment period when, in the opinion of the Engineer, conditions justify such action.

The contractor will not be required to keep planted areas cleared of trash and debris unless such trash and debris is a result of its operations. If, in the opinion of the Engineer, trash and debris has been deposited within the planted areas, not as a result of the contractor's operation, and such trash and debris is detrimental to the health and proper development of the plant material, the Engineer may require the contractor to clear the areas of this material.

The contractor's responsibility for the work during landscaping establishment shall be in accordance with the requirements of Subsection 104.10. All unacceptable planted stock, irrigation components and/or other work discussed at the monthly inspection and monthly irrigation testing shall be removed, replaced and/or repaired, as directed by the Engineer, at no additional cost to the Department within 21 calendar days from the date of the inspection. Payment for replacement of planted stock or irrigation components damaged by traffic or vandalism during landscaping establishment will be made in accordance with the requirements of Subsection 104.02. The contractor shall notify the Engineer in writing when the replacement work has been performed.

All erosion which occurs within decomposed granite, granite mulch and rock mulch areas shall be immediately repaired by the contractor to maintain the final grade in reasonably close conformity with the lines and grades shown on the project plans or as established by the Engineer. Erosion repair work shall be completed before the next monthly inspection and at no additional cost to the Department.

All electrical power required to maintain the landscaping will be supplied to the contractor at no charge during landscaping establishment. Electrical power used for electrical equipment and tools, and/or for the contractor's temporary offices shall be paid for by the contractor.

Water for temporary offices, construction equipment and construction yard use shall be furnished and paid for by the contractor.

**807-3.02 Planted Stock and Seeding Establishment:**

All dead or unhealthy plant stock shall be removed and replaced, as directed, at no additional cost to the Department, within 48 hours from the date of the inspection and the contractor shall notify the Engineer in writing when the replacement work has been performed. Stock furnished for replacement shall be of the same size and species as originally specified. Unhealthy plant material may be corrected by the use of chemical and fertilizer applications where and when approved by the Engineer.

After the final inspection and when all dead or unhealthy stock has been removed and, if directed, replaced, the contractor will then no longer be responsible for the replacement of plant stock.

In case of certain plant stock found to be dead or unhealthy at the inspections specified above, the contractor may be ordered to remove certain dead or unhealthy plant stock and may be ordered not to replace such plant stock when nonreplacement would not adversely affect the planting design. The initial furnishing and planting, and the subsequent removal of such plant stock ordered removed and not replaced shall be at no additional cost to the Department.

All unpaved areas within the right-of-way shall be kept cleared of weeds and other undesirable vegetation unless otherwise specified in the Special Provisions.

The control of weeds shall be accomplished either with herbicides or by manual methods. The types of herbicides to be used and the methods of application shall conform to Environmental Protection Agency requirements and labeling instructions, and shall be as approved by the Engineer. The contractor shall keep a record of all applications; the type of herbicides used, such as pre- or post-emergent; the rate and method of applications; and the date and location of such applications. A copy of this record shall be submitted to the Engineer after each application.

All grasses or weeds shall be eradicated by spraying with a suitable herbicide and removing by manual means.

Any person or persons applying pesticides will be considered as doing so for hire and shall be required to be licensed in accordance with the requirements of Title 3, Chapter 2, Arizona Revised Statutes, Article 6, Section 3-377.

Lawn areas shall be mowed, weeded, edged and trimmed in accordance with standard horticultural procedures. Watering and fertilizing of lawns shall be done at intervals necessary to maintain a uniform, healthy, desirable green color and sturdy growth.

The contractor shall water and maintain seeded areas to provide a uniform and satisfactory stand of grass. To be acceptable, lawns shall have a good, uniform color and sturdy growth. At least 98 percent of the area designated to be planted shall have an acceptable lawn.

**807-3.03 Irrigation System Establishment:**

The irrigation system shall be tested, adjusted, repaired, and operated in the manner in which it was designed to function. Components such as backflow prevention units and pressure reducing valves as well as all other appurtenances shall function properly in accordance with the requirements of the design and the Special Provisions, together with the recommendations of the manufacturer. No change in the system as it was accepted under the contract shall be made without written approval of the Engineer.

During landscaping establishment, emission points of emitters shall be repositioned as directed by the Engineer. Additional tubes shall be installed where necessary, as directed by the Engineer. Staking of additional tubes shall be done in accordance with the details shown on the project plans.

The irrigation system shall be tested within one week prior to each scheduled inspection. Testing of the various components shall be as specified in the Special Provisions or as directed by the Engineer. The contractor shall keep a record of the results of all testing and shall submit a copy of these results to the Engineer upon completion of each test.

**807-4 Method of Measurement:**

Landscaping establishment will be measured as a single complete unit of work.

**807-5 Basis of Payment:**

Landscaping establishment, measured as provided above, will be paid for at the contract lump sum price designated in the bidding schedule.

Partial payments may be made for landscaping establishment. Payment will be based upon the length of the landscaping establishment period, as specified in the Special Provisions, and the contract lump sum price for the item. Partial payment will be made only when the following work is completed prior to submittal of the monthly estimate:

(1) The Engineer's list of necessary work from the prior inspection.

(2) The contractor's list of proposed operations from its monthly work schedule.

If the contractor furnishes the water used during landscaping establishment, the cost shall be considered as included in the lump sum price bid for this contract bid item.

Payment for removal of trash and debris deposited within the planted areas, which is not a result of the contractor's operation, will be made in accordance with the requirements of Subsection 104.02.

## SECTION 808 WATER DISTRIBUTION:

**808-1 Description:**

The work under this section shall consist of furnishing all materials, equipment, tools and labor necessary to install a complete and functioning water distribution system and/or a complete and functioning landscape irrigation system in accordance with the details and at the locations shown on the project plans and the requirements of these specifications.

Water distribution plans are, in general, diagrammatic. The exact location of component units of the water distribution system will be specified by the Engineer.

The following water distribution terms, conditions, and component descriptions shall apply for installation of water distribution systems and/or landscape irrigation systems:

Main lines and/or pressure mains are defined as the piping under constant pressure. Supply mains are defined as the piping from a water source to a water storage facility and may or may not be under constant pressure. Submains shall be the piping between a control valve (manual or automatic) and a pressure regulating device and not under constant pressure. Lateral piping is that on the discharge side of a control valve or pressure regulating device and not under constant pressure. The work period for landscape establishment shall be the number of calendar days specified in the Special Provisions. Phasing of the project, when necessary, shall be as specified in the Special Provisions.

**808-2 Materials:**

**808-2.01 Components:**

**(A) Backflow Prevention Unit:**

Backflow prevention units shall be atmospheric, pressure or reduced pressure type and the size as specified. Backflow preventers and components shall conform to applicable codes, regulations, the project documents and the performance requirements of the Foundation for Cross Connection Control Research, University of Southern California. All testing of backflow prevention devices shall be as specified by the Foundation for Cross Connection Control Research, U.S.C.

Atmospheric and pressure type units may also be referred to as atmospheric vacuum breaker or pressure vacuum breaker.

**(1) Atmospheric Backflow Preventer:**

Atmospheric backflow preventers shall be all bronze body construction, non-spilling type with full size orifice, molded plastic or composition float disc. All units shall have female I.P.T. inlet and outlets sized as shown on the project plans and/or as specified in the Special Provisions.

Atmospheric units shall be rated to 125 pounds per square inch working pressure (minimum) and shall withstand water temperatures of 33 to 110 degrees F. The unit shall be installed with the air inlet in a level position.

**(2) Pressure Backflow Preventer:**

The pressure backflow preventer body and bonnet shall be bronze, and the air inlet hood or canopy shall be stainless steel or brass. Internally, the spring shall be stainless steel, the float shall be polyethylene and the vent and check discs shall be silicone rubber.

Internal components of the unit shall be serviceable without removal of the unit from the piping.

Pressure type units shall be rated to 150 pounds per square inch working pressure and shall withstand water temperatures of 33 to 210 degrees F. Pressure backflow preventers shall incorporate one spring loaded check valve which will close tightly when flow through the unit drops to zero and shall have an air relief valve that opens to break siphon when the internal pressure drops to one pound per square inch.

Each backflow device shall be manufacturer equipped with bronze-bodied, resilient seat shut-off valves on the inlet and outlet of the device and two ball-type test cocks.

**(3) Reduced Pressure Backflow Preventer:**

The reduced pressure backflow preventer shall consist of two independently operating check valves, an independent relief valve, resilient seat inlet and outlet, full port ball type shut-off valves and test cocks. The unit shall be designed for installation in a normal horizontal flow attitude. The independent relief valve shall be located between the two check valves.

The backflow preventer shall include an integral sensing system that will automatically open the relief valve whenever the pressure upstream of the first check valve drops below three pounds per square inch greater than the pressure in the zone between the two check valves. The relief valve shall remain open until a positive pressure differential of three pounds per square inch is reestablished. The sensing passage shall be located within the unit housing to protect against accidental damage or crimping. To assure maximum size passageway, snubber or other restrictive elements shall not be used.

In the event that pressure upstream of the first check valve drops to atmosphere or below, the construction of the unit shall be such that during the normal operation of the device, the level of water in the zone between the two check valves shall be lowered to create within the unit an internal air gap which is greater than the diameter of the inlet pipe.

Both check valves and the relief valve shall be spring loaded poppet type of modular design such that the complete assembly including valve, spring and seat may be removed and replaced using low cost replacement kits.

All parts shall be made from corrosion resistant materials.

The design shall place the sensing diaphragm and passage within the unit housing to eliminate danger of malfunction due to mechanical or vandalism damage.

The backflow preventer shall conform to the following material, pressure and temperature range requirements:

| | |
|---|---|
| Body | Bronze |
| Check Valve Enclosures | Glass Filled Noryl |
| Valve Disc | EPT Rubber |
| Diaphragm | Buna N and Nylon |
| "O" Rings | Buna N |

| | |
|---|---|
| Springs | Stainless Steel |
| Screws | Stainless Steel |
| Maximum Working Pressure | 150 psi |
| Hydrostatic Test Pressure | 300 psi |
| Temperature Range | 33 $^{o}$F – 210 $^{o}$F |

Construction of the backflow prevention unit shall be such that any minor leakage at the second check valve will result in a visible flow from the relief valve even if the first check valve is totally disabled.

Each reduced pressure backflow preventer shall be factory assembled and tested prior to delivery.

**(B) Gate Valve:**

Gate valves shall be the type and size specified on the project plans or in the Special Provisions. Identification of the valve by trade name, manufacturer and/or model number shall be stamped or cast on the valve body or on a permanently attached metal plate or tag. Unless otherwise specified, valves installed above ground shall be equipped with handwheels. Valves installed below grade shall be equipped with an operating nut or a cross handle, except a gate valve installed adjacent to a remote control valve, which shall be equipped with a handwheel.

A minimum of one operating key or wrench shall be provided for each size operating nut or cross handle.

**(1) Gate Valve (Three Inches or Smaller):**

Gate valves three inches or smaller shall be Class 125, bronze body, nonrising stem type with solid disc, screwed bonnet and required operator.

The bronze components of the valve shall conform to the requirements of ASTM B 62 with the exception of the stem which shall conform to ASTM B 371, Alloy 694. The handwheel, where required, shall be non-corrosive metal.

Valve end connections shall be as specified in the Special Provisions or as detailed on the project plans.

**(2) Gate Valve (Four Inches or Larger):**

Gate valves four inches or larger in size shall be iron body, bronze mounted and shall conform to the requirements of Federal Specification WW-V-58 Class 1, Type 1, for Class 125 valves having non-rising stem, bolted bonnet and solid wedge configuration.

End connections and required operator shall be as detailed on the project plans and/or as specified by the Federal Specifications.

**(C) Quick Coupling Valve:**

The quick coupling valve shall be bronze or brass with a 3/4-inch iron pipe size (I.P.S.) female inlet connection unless otherwise specified or detailed. The valve body shall be of two-piece construction with single slot and spring loaded self-closing valve with metal or rubber cover. All 3/4-inch quick coupling valves shall have a flow range of 10 to 20 gallons per minute and an operating pressure range of five to 125 pounds per square inch. All quick coupling valves shall be of a single manufacturer.

Two quick coupling keys appropriate to the valve shall be provided for each 10 valves installed.

Quick couplers shall be installed on an approved swing joint riser assembly consisting of two PVC male adapters with Acme threads and elastomer seals, one polyvinyl chloride (PVC) 90-degree street elbow with male and female Acme threads and two PVC 90-degree elbows with socket by female Acme threads. Necessary pipe, fittings and/or nipples shall be PVC Schedule 80; with the length as required.

Swing joint assembly shall be capable of withstanding a working pressure of 200 pounds per square inch at 73 degrees F.

### (D) Remote Control Valve:

The remote control valves shall be the types and sizes specified. The manufacturer's name and identification shall be cast molded or stamped on the valve body or on a permanently attached metal plate or tag. Valves shall have a minimum service rating of 150 pounds per square inch. Valve bodies, bonnets and component parts shall be as specified herein or in the Special Provisions.

All valves shall have accurately machined or molded valve seat surfaces and internal parts. End connections shall be machined or molded female I.P.S. thread unless otherwise specified. Electrically operated valves shall be fully compatible and fully functional in all modes with the automatic controller device specified for the project.

#### (1) Remote Control Valve (Plastic):

The plastic remote control valve shall be a normally closed, 24-volt A.C., 50/60-cycle, solenoid-actuated globe pattern, diaphragm-type valve capable of regulating water flow for the specified system operation. Valve pressure rating shall not be less than 200 pounds per square inch.

The valve body and bonnet shall be constructed of glass filled nylon with the handle, rings and diaphragm hardware of Acetal. Diaphragm shall be constructed of nylon reinforced Nitrile rubber. "O" rings shall be Ethylene Propylene rubber. Valve stem shall be brass and all studs and flange nuts shall be stainless steel.

The valve shall be actuated by a low power, epoxy encapsulated 24-volt A.C., 50/60-cycle solenoid with an in-rush power requirement of 0.41 amperes (9.9 VA) and a holding current of 0.23 amperes (5.5 VA). Control water pressure for the solenoid actuator shall be

delivered from the inlet of the valve to the actuator by means of an internal or external passage particular to the valve size.

Each valve shall be equipped with a manual on-off control and flow adjustment control. Manual operation of the valve shall be by manual internal or external bleed.

The valve construction shall be such as to provide for all internal parts to be removable from the top of the valve without disturbing the valve installation.

**(2) Remote Control Valve (Brass):**

The brass bodied remote control valve shall be a normally closed, 24-volt A.C., 50/60-cycle, solenoid-actuated globe pattern, diaphragm-type valve capable of regulating water flow for the specified system operation.

The valve body and bonnet shall be constructed of heavy cast brass. The diaphragm shall be nylon reinforced nitrile rubber. The valve stem and cross handle shall be brass and all studs shall be stainless steel. The internal seat spring shall be stainless steel.

The valve shall be actuated by a low power, epoxy encapsulated 24-volt A.C., 50/60-cycle solenoid with an in-rush power requirement of 0.41 ampere (9.9 VA) and a holding current of 0.23 ampere (5.5 VA). Control water pressure for the solenoid actuator shall be delivered from the inlet of the valve to the actuator by means of an internal or external passage particular to the valve size.

Each valve shall be equipped with a manual on-off control and flow adjustment control. Manual operation of the valve shall be by manual external bleed.

The valve construction shall be such as to provide for all internal parts to be removable from the top of the valve without disturbing the valve installation.

**(E) Automatic Controller:**

The automatic controller shall be electro-mechanical, electro-mechanical semi solid-state or microprocessor based / micro electronic solid-state type, and capable of fully automatic or manual operation of the irrigation system. The controller shall be housed in a wall or in a steel or metal cabinet which is lockable, pedestal mountable and waterproof. The type or types of auto controllers shall be as detailed on the project plans or as specified in the Special Provisions.

The controller shall operate on a minimum of 117 volts A.C. power input and shall be capable of operating 24-volt A.C. electric remote control valves.

**(F) 24-Volt Wire (Ground and Control):**

The 24-volt control and ground wire for operation of remote control valves shall be AWG size, UL approved, 600-volt, type UF single conductor wire with 60-mil PVC insulation. All control ("hot") wiring shall be a contrasting color to the white common or ground wire. Black

wire will not be acceptable for use on any 24-volt control circuit. Control wires to water distribution valves used for shrubs shall be a different color than those used for trees. Wire color shall be approved by the Engineer.

Control and ground wire sizes shall be the sizes indicated on the project plans. Individual control wires shall be installed to each remote control valve. Common wire installation shall be as detailed on the irrigation system master plan.

**(G) Pressure Gauge:**

The pressure gauge, portable or permanently mounted, shall be suitable for use with water and have a two-inch diameter case with hermetically sealed neoprene cover, molded-in diaphragm and a shatterproof crystal. Pressure gauges shall have a range of zero to 60 pounds per square inch, unless otherwise specified.

Portable pressure gauges shall be equipped with rubber hose and "tire chucks" capable of attachment to Schrader valves located at various pressure-check locations throughout the project for purposes of verifying pressures and making adjustments as necessary.

Permanently mounted pressure gauges shall be equipped with external or internal pulsation dampeners. All permanently mounted gauges shall be equipped with resilient seat, shut-off valves.

**(H) Insulation:**

The insulation shall be one-inch thick, all-service jacket, heavy density glass fiber, sectional pipe insulation with vinyl coated, embossed, vapor barrier laminate. The jacket shall have a pressure sensitive, self-sealing lap. All insulation shall receive an exterior protective cover of 0.016-inch aluminum secured with 3/8-inch aluminum straps located six inches center to center.

**(I) Pipe:**

**(1) Polyvinyl Chloride (PVC):**

Plastic pipe and fittings shall conform to the requirements of the National Sanitation Foundation and bear their stamp.

Materials used in the manufacture of PVC pipe and fittings shall conform to the requirements of ASTM D 1784, Class 12454-B.

PVC pipe shall conform to the requirements of ASTM D 2241 for SDR-PR pipe and ASTM D 1785 for Schedule 40 and Schedule 80 pipe.

The pipe classification and the pressure rating will be specified on the project plans or in the Special Provisions.

PVC pipe, unless otherwise specified, shall be plain-end solvent weld or bell-end solvent weld. Bell-end solvent weld pipe shall conform to the requirements of ASTM D 2672.

PVC piping shall be assembled with solvent weld, socket type fittings.

All PVC fittings shall conform to one or more of the following requirements:

(a) ASTM D 2466 for Schedule 40 socket type fittings.

(b) ASTM D 2467 for Schedule 80 socket type fittings.

**(2) Steel:**

Galvanized and black steel pipe shall conform to the requirements of ASTM A 120.

All threaded steel pipe fittings shall be heavy pattern, banded, malleable iron with a rating of 150 pounds per square inch working pressure. Fittings shall be galvanized or black steel appropriate to the piping being used. Flanges or flanged fittings, where specified, detailed or required, shall be Standard, Class 125 or Extra Heavy, Class 250 conforming to ANSI B 16.1.

The type of pipe and fittings which shall be used will be specified on the project plans or in the Special Provisions.

**(3) Copper**

All copper pipe shall be rigid or non-rigid copper, Type K Standard, meeting the requirements of Federal Specification WW-T 799 and ASTM B 88. Fittings shall be standard copper, wrought and cast. Solder shall be of the lead free type.

**808-2.02 Water Distribution System:**

Water distribution systems which include unique or variable components not listed in Subsection 808-2.01 shall conform to the component requirements specified in the Special Provisions.

**808-2.03 Landscape Irrigation System:**

Landscape irrigation systems which include unique or variable components not listed in Subsection 808-2.01 shall conform to the requirements specified in the Special Provisions.

**808-3 Construction Requirements:**

**808-3.01 Materials and Equipment:**

At the time of the preconstruction conference, the contractor shall submit to the Engineer seven copies of the manufacturer's product sheets of the materials and equipment it proposes to use. The contractor shall have materials and equipment correctly marked on

each copy of the manufacturer's product sheets. These product sheets shall also show the catalog numbers, manufacturer's name, model numbers, sizes, capacity, complete specifications, instructions, design data and/or drawings, to determine whether or not each piece of material or equipment is acceptable and to assure that all such materials and equipment, when incorporated into the work, will be in accordance with the project plans and these Specifications. The contractor's failure to comply with these material submittal instructions will not constitute time extensions.

No material or equipment shall be ordered and work shall not begin until the material and equipment has been approved, in writing, by the Engineer.

All water distribution system equipment shall be installed in accordance with the printed instructions of the manufacturer, the project plans, Standard Specifications, and Special Provisions. The contractor shall provide the Engineer three copies, unless otherwise specified, of each manufacturer's installation instructions.

All irrigation construction materials for single use on the projects shall be supplied from a single manufacturer, unless otherwise specified in the Special Provisions.

**808-3.02 Permits, Warranties and Guaranties:**

Any warranty, guaranty, operation and/or maintenance manuals provided by the manufacturer for any item shall be furnished to the Engineer prior to final acceptance of Phase I of the project or upon request by the Engineer.

All permits for installation or construction of any of the work included under Section 808, which are required by legally constituted authorities having jurisdiction, shall be obtained and paid for by the contractor, each at the proper time. The contractor shall also arrange for and pay all costs in connection with any inspections and examinations required by these authorities.

No measurement or direct payment will be made for any permits, the cost being considered as included in the price of the contract items.

**808-3.03 General Requirements:**

Any use of potable water by the contractor shall be through approved backflow prevention devices. All backflow prevention devices shall be in place, tested and approved for use by the Engineer prior to the contractor using any water from the municipal water system.

Prior to beginning trench excavation, the contractor shall lay out the system or systems for the approval of the Engineer by providing approved indicators at the location(s) of major components such as piping runs, valves, pumps, backflow preventers and tanks. Under no circumstances shall shut-off valves of any type be installed downstream from any atmospheric type backflow prevention device. With the exception of reduced pressure type, backflow preventers shall not be subject to back pressure. Structures and enclosures shall be indicated as directed by the Engineer.

The contractor shall locate any existing water distribution system piping and appurtenances within the limits of the project which will be affected by new system construction and/or revisions.

Utility connections, both water and electrical, shall be as shown on the project plans or as determined by the utility company. Unless specifically exempted in the plans or specifications, the contractor shall be responsible for all costs to provide these services.

The contractor shall assume full responsibility for the correct installation of the water distribution system, as herein specified, and unless it can show past experience of installing this type of system, it shall arrange with the manufacturer for the services of a qualified manufacturer's representative to be on hand at the start of the installation and as necessary during the installation and testing of the system.

All materials and fittings shall be new, of manufacturer's most current design, and shall bear the appropriate national association's seal of approval; for example, NSF and UL. Similar parts shall be procured from the same manufacturer, and internal parts shall be common and interchangeable. Parts listing and source of supply for replacement parts shall be furnished to the Engineer. The contractor shall provide two complete manuals of all materials, equipment, parts, and manufacturer's installation, maintenance and owner manuals, to the Engineer prior to final project acceptance.

All enclosures shall remain closed and locked, and all valve box covers shall be in place throughout the construction and landscaping establishment periods, except when actual work is in progress on the respective unit.

The contractor shall furnish sufficient numbers of pressure gauges with tire chucks, which shall be used in the testing and necessary adjustment of the emitter system during construction and landscaping establishment.

All pressure regulators shall be tested at 90-day intervals throughout phases I and II of the contract. Regular tests shall be performed a minimum of three working days prior to regularly scheduled project inspections.

Plastic pipe shall be delivered to the site in unbroken bundles or packages and shall be wrapped such that pipe ends are adequately protected. If the pipe is delivered from a local warehouse, the pipe need not be bundled or wrapped.

Upon delivery to the site, the contractor shall inspect all pipe for possible shipping damage. Shipping straps shall be removed to prevent damage due to expansion in hot weather.

All copper pipe required to install the backflow prevention unit or fertilizer injector assembly shall be type "K," hard drawn, of the size shown on the project plans. Copper fittings shall be wrought or cast, and of the configuration and size shown on the project plans.

All PVC pipe and fittings shall be stored as recommended by the manufacturer and as directed by the Engineer. All PVC pipe shall be covered to prevent exposure to sunlight.

Sufficient air space shall be provided between the opaque covering material and the pipe to prevent undue heat buildup and retention.

PVC pipe which has been discolored by exposure to sunlight or has been scratched, scored or otherwise damaged in handling will not be acceptable.

Plastic pipe and fittings shall be installed in accordance with the requirements specified herein and the manufacturer's recommendations.

Any PVC fitting or nipple marks from any device other than a strap tightening wrench shall be removed and replaced with a new component. Any system replaced shall be retested as herein specified.

No water distribution system main piping, laterals, other piping, or other components shall be installed through or beneath new or existing plant pits or plant material. The minimum distance between the plant pit and piping shall be 12 inches. Maximum distance between the plant pit and piping shall be determined by maximum supply lengths as specified on the project plans.

Additional flushing of the irrigation system, in addition to those specified, may be required by the Engineer to assure proper function of the system, including emission points.

Testing of the irrigation system valves shall be performed at system operating pressure or 60 pounds per square inch, whichever is greater.

Trenches shall be excavated to uniform grade and shall be no wider than is necessary for the proper installation of the pipe, fittings and control wiring. The bottom of the trench shall be firm and free from large or sharp rocks.

Where pavement or other impervious material is encountered in the excavation of trenches, such material shall be removed and wasted, as approved by the Engineer. No separate payment will be made for removal and disposal.

All pipe, fittings and system components shall be clean prior to installation and shall be maintained in that condition during installation.

Plastic pipe shall be uniformly bedded and covered to the depth indicated on the project plans. Bedding and backfill material shall be compacted by approved water settlement methods and, after backfilling has been completed, the surface shall be brought to the elevation of the adjacent ground. The contractor shall select a 100-foot section of mainline which has been installed and backfilled as a test portion to be water settled for the Engineer's approval of the water settlement method. The test shall be completed and approved prior to proceeding with the remainder of the project.

Requirements for slack or "snaking" of PVC pipe shall be in accordance with the pipe manufacturer's recommendation. PVC pipe and fittings shall be clean prior to installation and shall be maintained in that condition during installation.

Where two or more piping systems are indicated on the project plans as adjacent, they shall be placed within a common trench and at the depths indicated.

Where threaded plastic to metal or plastic to plastic connections are required, the metal connections shall be worked first. A non-hardening, manufacturer recommended sealant/lubricant compatible with the plastic fittings and/or components shall be used and the joint shall be hand tightened with the final tightening not to exceed one turn with a strap wrench.

Threaded PVC Schedule 80 nipples, thread-one-end (T.O.E.) and PVC Schedule 80 couplings, solvent weld, shall be used where threaded plastic connectors are required. Threaded PVC male or female adapters are not acceptable, unless otherwise specified.

Cement, solvents, thinners and joint compounds shall be compatible with and of the kind recognized by the industry as proper for use with the plastic pipe and fittings involved. Solvent weld pipe and fittings shall be assembled using appropriate primers and solvents designated by the manufacturer for use with Schedule 40 and/or Schedule 80 fittings.

All wire connections for No. 10 or larger shall be wrapped in accordance with the requirements of Subsection 732-3.02(B).

All control valve boxes and pressure regulator boxes shall be labeled with a brass tag acceptable to the Engineer.

All wire shall be tagged in accordance with the requirements of Subsection 732-3.02(C). Flexible conduit shall be supported within 12 inches of any cabinet or fitting in accordance with the requirements of NEC 350 and in a workmanlike manner acceptable to the Engineer.

All surfaces or components requiring protective paint shall receive the finish as specified in Sections 610 and 1002, and as determined by the Engineer.

The contractor shall furnish and install a steel post to mark the ADOT end caps, in accordance with Standard Drawing 4-M-4.01, to a height of 30 inches without the reflector.

At no time shall any plant material, new or existing, be allowed to remain without water for any period which will result in stress to the plant material. Any damage to plant material because of lack of water shall be rectified at no additional cost to the Department.

Water distribution and/or irrigation systems shall be installed, tested, operational and approved by the Engineer prior to installation of any new plant material.

Flush end caps shall be installed as shown on the project plans or as directed by the Engineer to promote good flushing of the entire irrigation system. Additional flushing of the irrigation system, in addition to those specified, may be required by the Engineer to assure proper function of the system including emission points.

Testing of the irrigation system valves shall be performed at system operating pressure or 60 pounds per square inch, whichever is greater.

**808-3.04 Bedding and Cover Material:**

Bedding and cover material for PVC piping, flexible emitter hose and 24-volt wiring shall be sand conforming to the gradation requirements of Subsection 1006-2.03(B) with the following exceptions:

| Sand Bedding Sieve Size | Percent Passing |
|---|---|
| No. 4 | 100 |
| No. 16 | 30 - 80 |
| No. 50 | 0 - 30 |
| No. 100 | 0 - 25 |
| No. 200 | 0 - 20.0 |

All piping and 24-volt wire shall be installed as detailed on the project plans and shall have the minimum cover shown.

Gravel sumps, as detailed on the project plans, shall be crushed coarse aggregate Number 57 conforming to the requirements of AASHTO M 43.

**808-3.05 Components:**

Components shall be as required by the details shown on the plans, in the project Special Provisions, as specified herein, and as directed by the Engineer.

**(A) Backflow Prevention Unit:**

The backflow prevention unit shall be installed with necessary supports as required by the project documents. The piping, as detailed shall not be considered as adequate support. Shop drawings shall be provided by the contractor in accordance with the requirements of Subsection 105.03 of these specifications. The supports shall receive protective paint finish as specified in Sections 610 and 1002 of these specifications. Final finish shall be as specified by the Engineer.

All exposed piping and unit bodies used in conjunction with the backflow preventer and the backflow preventer shall receive a protective covering of insulation as specified.

Access to all drains, vents, operators, unions or reliefs shall be maintained and the insulation shall not restrict their operation.

The backflow prevention units shall be tested in accordance with the requirements as specified in the Manual of Cross-Connection Control Recommended Practice, as published by the Foundation for Cross-Connection Control Research, University of Southern California.

Testing of backflow prevention unit shall be performed by the authorized service-test personnel. Test reports shall be recorded on forms provided by the Engineer. No separate payment will be made for testing.

Testing of backflow prevention units by authorized service-test personnel shall be performed before acceptance of both Phases I and II. In addition, testing shall be performed following any repairs or servicing of units.

All backflow prevention devices shall be in place, tested and approved for use by the Engineer prior to the contractor using water from any potable water system.

All testing shall be with available water pressure from the approved points-of-connection (P.O.C.), unless otherwise directed by the Engineer. Bench testing remote from the designated location of the unit will be unacceptable.

**(B) Gate Valve:**

Gate valves shall be the size(s) as indicated in the project documents. Gate valve size shall be equal to the larger adjacent pipe size as indicated on the project plans.

All gate valves installed beyond structure lines shall be installed within specified valve boxes. No valves shall be placed beneath structures, sidewalks, roadway surfaces or within structural walls or columns unless shown on project plans and approved by the Engineer.

Concrete support blocks for mainline gate valves shall be the type and size indicated on the project plans. Support blocks shall be installed under the gate valve body and shall not contact or support the adjacent pipe and fittings. Support blocks shall be placed on undisturbed soil or soil which has been compacted as specified in Subsection 203-5.03(B)(4) of these specifications. No separate payment will be made for the support block.

Gate valves installed in valve boxes or enclosures below grade shall be exposed in entirety within the valve box. Extensions shall be added to valve boxes as necessary to prevent the surrounding soil or gravel sump from encroaching on the valve body and associated piping or fittings.

**(C) Quick Coupling Valve:**

Quick coupling valves, the type and size as detailed on the project plans and as specified, shall be installed on the approved swing joint riser assembly. Additional pipe and/or nipples required to complete the swing joint assembly shall be PVC, Schedule 80; length shall be as required.

Quick coupling valves shall be anchored to prevent movement as detailed on the project plans.

**(D) Remote Control Valve:**

Remote control valves shall be installed as detailed on the project plans. Size of valves shall be as shown on the plans or as specified in other project documents.

Unless otherwise detailed or specified, all remote control valves for use on irrigation systems shall be preceded by a gate valve. The gate valve shall be the size detailed or sized to the larger of either the control valve or the adjacent pipe.

Remote control valves, accompanying gate valves and other required appurtenances shall be completely exposed and accessible within the valve box. Valve box extension shall be added as necessary to provide valve access and inspection/maintenance.

**(E) Automatic Controller:**

Automatic controllers (or field satellite) shall be installed as detailed and specified in the project documents, as recommended by the manufacturer and as approved by the Engineer.

Controller enclosures shall remain closed and locked throughout the project duration except when actual work is in progress on the respective unit.

Any finish or enclosure component damaged during transport or installation shall be repaired or replaced as directed by the manufacturer and approved by the Engineer.

Remote control valve wire (ground and control) shall terminate within the automatic controller cabinet at a manufacturer supplied terminal strip. All connections shall be labeled as to function and/or valve number as approved by the Engineer. Incoming electrical supply circuit(s) shall be separated from the low voltage (24-volt) circuits by approved conduits or separator panels as approved by NEC and prevailing local codes.

**(F) Control and Ground Wire (24-Volt):**

Remote control wire (24-volt) shall be installed as specified by the project documents and Standard Specifications.

Control wires to be installed throughout pipe sleeves shall be encased in PVC electrical conduit of appropriate size to contain the required number of conductors as determined by standard conduit sizing tables. Conduits shall extend one foot beyond each end of the sleeve unless otherwise noted.

Wire connections at remote control valves and at field splices shall be made with specified wire connectors installed as recommended by the manufacturer. No field splices of 24-volt wiring shall be made unless the length between connections or splices exceeds 2,500 feet. Necessary splices shall be made at remote control valve boxes or separate splice boxes.

Control and ground wire throughout the project shall be neatly bundled and taped with plastic electrical tape at 10-foot intervals between splices and/or connections and as directed by the Engineer.

**(G) Emitters:**

The number of emitters per riser circuit, as shown on the project plans, is approximate. The contractor shall add no more than five additional single outlet emitters or one multi-outlet emitter per circuit, as detailed. Any additional emitters required and exceeding the above indicated amount must be approved by the Department.

The contractor shall assume full responsibility for the correct installation of the emitter system, as herein specified, and unless it can show past experience of installing this type of system, it shall arrange with the manufacturer for the services of a qualified manufacturer's representative to be on hand at the start of the installation and as necessary during the installation and testing of the system.

The contractor shall use the appropriate installation tools as recommended by the respective manufacturers for correct installation of emitters and emitter tubing.

**(H) Insulation:**

All exposed pipe, fittings and unit bodies used in conjunction with the backflow preventers, fertilizer injectors and filter units as well as all exposed piping and valves at the water storage facilities and pumping facilities shall receive a protective covering of insulation. Access to all drains, vents, operators, unions or reliefs shall be maintained and shall not be restricted in their operation by the insulation.

Insulation shall be installed in a workmanlike manner with no voids or openings which will deter from the effectiveness of the insulation.

The contractor shall assume full responsibility for the correct installation of the insulation and shall arrange with the manufacturer for the services of a qualified manufacturer's representative to be on hand at the start of the insulation installation and as necessary during installation to assure proper application of all insulation materials.

**808-3.06 Testing Prior to Backfilling:**

The contractor shall furnish a sufficient number of pressure gauges with "tire chucks" which shall be utilized in the testing and necessary adjustment of the water distribution system during construction and landscaping establishment.

At the completion of the landscaping establishment period, the contractor shall deliver two pressure gauges and two tire chucks to the Engineer.

All enclosures shall remain closed and locked and all valve box covers shall be in place throughout the construction and landscaping establishment periods except when actual work is in progress on the respective unit.

When tests have been completed and any necessary repairs have been completed and accepted, trenches shall be backfilled. Pipe lines shall be normalized by water cooling the system just prior to beginning backfilling operations.

The irrigation laterals shall be thoroughly flushed following assembly and backfilling of the trench. All laterals shall receive an additional flushing prior to installation of the irrigation heads. Additional flushing of the water distribution system may be required by the Engineer to assure proper function of the system including irrigation system devices.

The contractor shall operate the irrigation system automatically for a minimum of five days prior to final acceptance of Phase I and for the duration of Phase II. The contractor may operate the system manually, in addition to the automatic mode and as necessary during Phase II, as approved and directed by the Engineer.

Any mechanical failure or leak that occurs during the establishment period shall be repaired or the defective materials shall be removed and replaced as directed by the Engineer. The system shall be retested as herein specified.

**808-3.07 Water Distribution System:**

The specifications for installing a water distribution system will be provided in the Special Provisions.

**808-3.08 Landscape Irrigation System:**

The specifications for installing a landscape irrigation system will be provided in the Special Provisions.

**808-3.09 Water Distribution System Testing:**

Following completion of the installation of mains, control valves, gate valves and other components, and after all solvent-welded joints have cured for 24 hours, the water distribution system and/or landscape irrigation system shall be tested in accordance with the requirements of the Specifications and as approved by the Engineer.

Under no circumstances will air pressure be acceptable for testing.

The contractor shall flush and bleed all lines prior to testing. Metal or plastic caps shall be used to facilitate flushing and testing. Backfill material placed on the lines shall be limited to the quantity required to stabilize the lines under pressure and to serve as insulation during testing procedures. During testing, all fittings and couplings shall be visible for inspection. Any failures evident during the test shall be repaired and the system retested before backfilling. The contractor shall furnish the necessary equipment required to perform the piping tests. No additional payment will be made for materials required to perform tests.

Any mechanical failures or leaks which develop during testing shall be repaired or the defective materials shall be removed and replaced. After replacements or repairs have been made, the entire testing procedures shall be repeated until it is determined that there are no leaks or failures in the irrigation system.

Unless otherwise specified in the Special Provisions, the pressure mains and sub-mains shall be subjected to a static pressure test of 100 pounds per square inch gage for a minimum period of two hours. During this time all solvent-welded and threaded connections and component parts shall be inspected to determine that no leaks exist.

After installation of emitter laterals and supply tubing, but before installation of emitters, the emitter laterals and supply tubing shall be subjected to one hour of pressure testing, (pounds per square inch gage) at maximum lateral operating pressure unless otherwise directed by the Engineer, during which time components shall be inspected for leakage.

All valves shall be tested in sequence, starting at the valve most remote from the source of water supply, to subject the mainlines to surge pressure. All valves shall be operated manually. All electric remote control valves shall also be tested electrically and meet the satisfaction of the Engineer prior to burial of wiring.

In addition to the aforementioned testing, the contractor shall perform the various testing procedures listed under the various individual bid items. These tests shall be performed in the presence of the Engineer. The results of the tests shall be documented and provided to the Engineer at the completion of the testing procedure. Test document forms shall be provided by and/or approved by the Engineer.

**808-4 Method of Measurement:**

Water distribution systems or landscape irrigation systems will be measured either by the system for each system installed or by the unit each for each component furnished and installed, which collectively comprises the system. The applicable unit of measurement will be as designated in the bidding schedule.

**808-5 Basis of Payment:**

The accepted quantities of water distribution system or landscape irrigation system, measured as provided above, will be paid for at the contract unit price for the pay unit designated in the bidding schedule, which price shall be full compensation for the item, complete in place, including excavation and furnishing all labor and materials necessary to provide a functioning water distribution system or landscape irrigation system.

## SECTION 809 SEWERAGE SYSTEM:

**809-1 Description:**

The work under this section shall consist of furnishing and constructing a complete and functioning sewerage system, including all appurtenances, excavating, backfilling, setting of all parts of the system to the indicated lines and grades, testing the system and the disposal of excess materials, all in accordance with the details and at the locations shown on the project plans and the requirements of these Specifications.

**809-2 Materials:**

**809-2.01 Plastic Sewer Pipe:**

The contractor may, at its option, use either acrylonitrile-butadiene styrene (ABS) or polyvinyl chloride (PVC) sewer pipe. All plastic sewer pipe shall be SDR 35 in the sizes indicated on the project plans.

ABS pipe and fittings shall be manufactured in accordance with the requirements of ASTM D 2751. Solvent cement conforming to the requirements of ASTM D 2235, shall be used on all ABS plastic pipe joints.

PVC pipe and fittings shall be manufactured in accordance with the requirements of ASTM D 3034. Solvent cement conforming to the requirements of ASTM D 2564 or elastomeric rubber ring gasket joints conforming to the requirements of ASTM D 3212, shall be used on all PVC plastic pipe joints. All pipe joined with rubber ring gasket joints shall be the push-on, bell and spigot type. Each bell joint shall consist of an integral factory made formed bell complete with a single rubber gasket.

**809-2.02 Iron Pipe and Fittings:**

All iron pipe shall be ductile iron pipe conforming to AWWA Standard C-151. All fittings shall be either cast iron or ductile iron pipe fittings conforming to AWWA Standard C-110. All iron pipe shall be of the sizes and classes shown on the project plans.

All iron pipe and fittings shall have an inside cement-mortar lining conforming to AWWA Standard C-104.

**809-2.03 Filter Fabric:**

Filter fabric shall conform to the requirements of Subsection 1014-4 for the fabric survivability rating shown on the project plans or specified in the Special Provisions.

**809-3 Construction Requirements:**

**809-3.01 General:**

At the time of the preconstruction conference, the contractor shall submit to the Engineer seven copies of the manufacturer's product sheet of all materials and equipment that it proposes to incorporate into the work. The contractor shall have materials and equipment correctly marked on each copy of the manufacturer's product sheet. These product sheets shall also show the catalog numbers, manufacturer's name, model numbers, sizes, capacity, complete specification, instructions, design data and/or drawings, to determine whether or not each piece of material or equipment is acceptable and to assure that all such materials and equipment, when incorporated into the work, will be in accordance with the project plans and these specifications. The contractor's failure to comply with these material submittal instructions will not constitute time extensions.

At the time of the preconstruction conference, the contractor shall submit to the Engineer seven copies of the list of all materials and equipment that it proposes to incorporate into the work. The contractor shall have materials and equipment correctly marked on each copy of the list. This list shall show the catalog numbers, manufacturer's name, model numbers, sizes, capacity, complete specification, instructions, design data and/or drawings, to determine whether or not each piece of material or equipment is acceptable and to assure that all such materials and equipment, when incorporated into the work, will be in accordance with the project plans and these Specifications. The contractor's failure to comply with these material submittal instructions will not constitute time extensions.

No material or equipment shall be ordered and work shall not begin until the material and equipment has been approved, in writing, by the Engineer.

Construction of sewerage systems shall be governed by the applicable requirements of the Arizona Department of Environmental Quality.

All plastic and iron pipe shall be transported, handled and stored in accordance with the manufacturer's recommendations. PVC plastic pipe shall be protected from sunlight with an opaque covering.

Workmen and inspectors shall be protected from the collapse of trench walls during the excavating for and the placing of pipe and septic tanks, during the placing and compacting of all bedding and backfill material and during the determination of all earth work densities.

**809-3.02 Manholes:**

Manholes and covers shall be constructed in accordance with the requirements of Section 505 and as shown on the project plans.

**809-3.03 Septic Tanks:**

Septic tanks shall be constructed in accordance with the project plans and the current edition of Arizona Department of Environmental Quality Engineering Bulletin No. 12.

Septic tanks shall be water tight and constructed with Class S concrete which has a 28-day compressive strength of at least 3,000 pounds per square inch and Grade 40 or better steel reinforcing bars. If precast septic tanks are used, a bituminous or mastic gasket shall be used to seal the joints between each precast section.

The liquid depth in the septic tank shall not be less than four feet or greater than six feet. The inside length of the septic tank shall be between two and three times the inside width. The inlet and outlet of the septic tank shall consist of pipe tees which shall be sized to match the sewer line.

The septic tank shall have three access openings in the tank top. One opening each shall be located over the tank inlet and outlet and the third opening shall be located in the middle of the tank. Concrete adjustment rings shall be used as required so that all three access openings are within six inches of the finished grade.

Backfill around and over the septic tank shall be placed in lifts not greater than 12 inches and thoroughly compacted in a manner that will not place undue strain on the septic tank.

**809-3.04 Plastic Sewer Pipe:**

The installation of solid wall plastic sewer pipe shall conform to the requirements of ASTM D 2321.

Trenches for plastic sewer pipe shall be excavated to a uniform grade which will not cause undue deflection of the pipe. The width of the trench at any point below the top of the pipe shall not be greater than that necessary to provide adequate room for joining the pipe and compacting the haunching and initial backfill. The trench bottom shall be firm and free of large or sharp rocks.

Materials for the pipe bedding, haunching and initial backfill shall conform to the requirements of Subsection 808-3.04.

Materials for pipe bedding, haunching and initial backfill shall be placed in lifts of not more than eight inches in depth before compaction, and each lift shall be compacted to at least 90 percent of maximum density as determined in accordance with the requirements of the applicable test methods of the ADOT Materials Testing Manual, as directed and approved by the Engineer.

If rock is encountered during trench excavation, all rock shall be removed to provide a clearance of at least six inches below and on each side of the pipe and fittings. After excavation of all rock, six inches of pipe bedding material shall be placed in the bottom of the trench and compacted to at least 95 percent of maximum density as determined in accordance with the requirements of the applicable test methods of the ADOT Materials Testing Manual, as directed and approved by the Engineer.

Other pipe bedding shall be a minimum of four inches in depth under the pipe and shall be installed to insure adequate support of the pipe barrel throughout its entire length. The haunching shall be placed completely around the pipe up to the spring line of the pipe and out to the undisturbed trench walls and uniformly tamped, avoiding any lateral displacement of the pipe. The initial backfill shall extend a minimum of 12 inches over the top of the pipe and shall be carefully and uniformly tamped. The final backfill shall be of excavated material containing no slabs or pieces of rock greater than four inches in maximum dimensions and shall be water settled or mechanically placed as approved by the Engineer. When completed, the final backfill shall be at the same elevation as the adjacent ground surface and shall be passable by conventional rubber tired vehicles without greater rutting than the adjacent natural ground.

Proper care shall be taken to avoid contact between the pipe and compaction equipment. Compaction equipment shall not be used directly over the pipe until sufficient backfill has been placed to assure that such equipment will not damage or disturb the pipe. At least 30 inches of backfill shall cover the pipe before the trench is wheel loaded and at least 48 inches of backfill material shall be in place before compacting with a hydrohammer.

**809-3.05 Iron Pipe:**

Trench excavation for the iron pipe shall be no wider than is necessary for proper installation of the pipe.

The trench bottom shall be true and even in order to provide support for the full length of the pipe barrel. Holes for the bells shall be provided at each joint and shall be no larger than necessary for joint assembly and assurance that the pipe barrel will lie flat on the trench bottom.

If rock is encountered during trench excavation, all rock shall be removed to provide a clearance of at least six inches below and on each side of the pipe. After excavation of all rock, a six-inch bed of soil which is free of stones, large clods or foreign matter shall be placed on the bottom of the trench, leveled and tamped.

The materials for pipe bedding, if required, and for the haunching and initial backfill for the iron pipe shall be soil free from stones, large clods or foreign matter. The backfill shall be placed completely under the pipe haunches and up each side of the pipe and uniformly tamped. The backfill shall be placed in lifts not exceeding eight inches in depth, and each lift shall be compacted to at least 90 percent of maximum density as determined in accordance with the requirements of the applicable test methods of the ADOT Materials Testing Manual, as directed and approved by the Engineer. The final backfill shall be excavated material containing no slabs or pieces of rock greater than four inches in maximum dimension and shall be water-settled or mechanically placed as approved by the Engineer. When completed, the final backfill shall be at the same elevation as the adjacent ground surface and shall be passable by conventional rubber-tired vehicles without greater rutting than the adjacent natural ground.

**809-3.06 Filter Fabric:**

The installation of the filter fabric shall conform to the requirements of Subsection 208-4.

**809-3.07 Inspection and Testing:**

The inspection and testing of the sewer lines shall be performed following formal notice to the Engineer. The sewer lines shall be inspected, tested and accepted prior to being covered. All pipe and fittings will be carefully examined during the testing procedure. Any damaged or defective pipe or fittings that are discovered during or following testing shall be repaired or replaced with sound material and then retested until approved by the Engineer. The sewer line shall be tested by means of an exfiltration test. This test shall be conducted in accordance with the requirements of Engineering Bulletin No. 11, of the Arizona Department of Health Services and as follows:

Plug sewer line at lower end of section to be tested.

Plug the highest end of the sewer line to be tested. The sewer plug shall have a suitable air vent to allow trapped air removal.

Place a calibrated container at the average height of four feet above the flow line of the sewer line. Check the system for leaks in hoses, plugs, calibrated containers, etc., while filling through a positive shut-off valve. After filling the sewer line, allow one hour for absorption of water and refill sewer line. When the water overflows the calibrated container, close the input valve and begin the test.

Record the elapsed time to empty the container of water and calculate the loss rate in gallons per hour.

The exfiltration rate from the sewer line shall not exceed 0.158 gallons per inch of pipe diameter per 100 feet of pipe length per hour with four feet of head.

**809-4 Method of Measurement:**

Sewerage systems will be measured either as a single complete unit of work or by the unit of measurement shown below and listed in the bidding schedule for the specified items:

Septic tanks will be measured either as a single unit of work, complete, or as a unit for each tank constructed.

Sewer pipe will be measured by the linear foot of pipe or as a single unit of work, complete, including excavating, backfilling, pipe, sand bedding and testing.

Manholes will be measured in accordance with the requirements of Subsection 505-4.

Filter fabric will not be measured for payment.

**809-5 Basis of Payment:**

The accepted quantities of sewerage system, measured as provided above, will be paid for at the contract unit price specified in the bidding schedule, complete in place.

## SECTION 810 EROSION CONTROL AND POLLUTION PREVENTION:

**810-1 Description:**

The work under this section shall include furnishing, installing, maintaining, removing and disposing of temporary erosion control measures such as silt fences, check dams, straw barriers, and other erosion control devices or methods as shown in the Storm Water Pollution Prevention Plan (SWPPP) and in the Special Provisions.

The work shall also include furnishing, installing, and maintaining permanent erosion control measures such as pipe inlet and outlet protection, cut and fill slope transitions, headwall

and wingwall treatments, and other permanent erosion control devices or methods as shown in the SWPPP.

**810-1.01 Erosion Controls:**

Erosion controls, both temporary and permanent, shall be installed in accordance with phasing provisions in the approved SWPPP and coordinated with the related construction.

All work specified in this subsection will be temporary for use during construction, unless designated otherwise.

The contractor shall be responsible for maintaining all erosion and pollution control devices in proper functioning condition at all times.

When deficiencies in the erosion control devices or other elements of work listed herein are noted by inspection or other observation, specified corrections shall be made by the contractor by the end of the day or work shift, or as directed by the Engineer.

Work specified herein which is lost, destroyed, or deemed unacceptable by the Engineer as a result of the contractor's operations shall be replaced by the contractor at no additional cost to the Department. Work specified herein which is lost or destroyed as a result of natural events, such as excessive rainfall, shall be replaced by the contractor and be paid for in accordance with the requirements of Subsection 109.04.

In cases of serious or willful disregard for the protection of the waters of the U.S. and/or natural surroundings by the contractor, the Engineer will immediately notify the contractor of such non-compliance. If the contractor fails to remedy the situation within 24 hours after receipt of such notice, the Engineer may immediately place the erosion and/or other pollution control elements in proper condition and deduct the cost thereof from moneys due the contractor.

**810-1.02 Other-Pollutants Controls:**

The work shall include implementing controls to eliminate the discharge of pollutants, such as fuels, lubricants, bitumens, dust palliatives, raw sewage, wash water, and other harmful materials; into storm and other off-site waters. The work shall include the implementation of spill prevention and material management controls and practices to prevent the release or washoff of pollutants. These controls and practices shall be specified in the SWPPP and shall include storage procedures for chemicals and construction materials, disposal and cleanup procedures, the contractor's plans for handling of potential pollutants, and other pollution prevention measures as required.

Handling procedures for potential pollutants shall also be included in the contractor's "good housekeeping" practices, as specified in Subsection 104.09 of the Special Provisions.

**810-2 Materials:**

**810-2.01 Silt Fence:**

Material requirements for silt fences, including posts, wire support fencing, and fasteners, shall be in accordance with Section 915. Geotextile fabric shall conform to the requirements of Subsections 1014-1 and 1014-8, except that the filter cloth shall be woven polypropylene, and the fabric Apparent Opening Size shall be between numbers 20 and 50 U.S. Standard sieve sizes, when tested in accordance with ASTM D 4751.

**810-2.02 Straw Bales:**

Straw shall be in three-tie bales approximately 40 inches long by 24 inches wide by 14 inches high. Straw shall be well compacted with a low seed content. Ties shall be nylon string.

Stakes shall be wooden stakes, two-by-two inches by four feet.

**810-2.03 Riprap and Rock Mulch:**

Riprap for cut and fill transitions designated on the plans shall conform to the requirements of Section 913 and shall be in accordance with the following table, unless otherwise specified. Riprap for cut and fill transitions shall conform to gradation A or B as designated on the project plans.

| Sieve Size | | Percent Passing |
|---|---|---|
| Gradation A | Gradation B | |
| 6 inch | 12 inch | 90 - 100 |
| 4.24 inch | 9 inch | 70 - 85 |
| 3 inch | 6 inch | 30 - 50 |
| 2 inch | 4 inch | 5 - 15 |
| 1 inch | 2 inch | 0 - 5 |

Rock mulch for pipe inlet and outlet protection, headwall and wingwall treatment, and rock check dams shall conform to the requirements of Section 803 and shall be in accordance with gradation C below, unless otherwise specified. Section 803 requirements for use of pre-emergent herbicide and for post-placement watering of rock mulch shall not apply to rock mulch applied under Section 810.

| Gradation C | |
|---|---|
| Sieve Size | Percent Passing |
| 3 inch | 100 |
| 2 inch | 50 - 75 |
| 1 inch | 10 - 20 |

**810-2.04 Sand Bags:**

Sand bags, when filled, shall measure approximately 24 inches long by 16 inches wide by four inches thick. Bags shall be manufactured from polypropylene, polyethylene, or polyamide woven fabric with the following characteristics:

| | |
|---|---|
| Unit Weight, Minimum, oz. per sq. yd. | 4 |
| Mullen Burst Strength:, Exceeding, p.s.i. | 300 |
| Ultraviolet Stability, Exceeding, % | 70 |

Material used to fill sand bags shall be clean sand or a clean sandy soil free of silt, as approved by the Engineer.

**810-3 Construction Requirements:**

The contractor shall implement the SWPPP throughout the project, as specified in Subsection 104.09 of the Special Provisions.

Erosion control features shall be temporary or permanent, as designated herein. Temporary erosion control features specified for removal at the end of the project shall become the property of the contractor, unless designated by the Engineer to be left for permanent use.

**810-3.01 Silt Fences:**

Installation and maintenance requirements for silt fences shall be accordance with Section 915, unless otherwise specified.

**810-3.02 Straw Bales:**

**(A) General:**

Straw bales shall be installed in accordance with the project plans and details or as directed by the Engineer. The bottom of all bales shall be embedded four to six inches into the ground. In locations where rows of bales are installed, joints between bales in adjacent rows shall be staggered.

Straw bales shall be staked as shown on the project plans and details. Stakes shall be driven flush with the top of the bale, skewed in directions opposite to the skew of adjacent stakes, and perpendicular to the direction of flow. In areas where straw bales may be allowed to remain in place, wood stakes must be used. In other areas, No. 4 steel bars may be used. A minimum of two stakes shall be used for each bale.

Straw bales shall be installed tightly together to form a cohesive unit without gaps or voids. Joints between bales shall be hand packed with straw to maintain a uniform density throughout the unit and to eliminate voids.

The contractor shall maintain all straw bales in a functional condition. Accumulated sediment shall be removed and disposed of by the contractor when approximately 75 percent of the original capacity has been filled with silt, or as directed by the Engineer.

Straw-bale features shall remain in service until disturbed areas have been stabilized, as directed by the Engineer.

When the use of a straw bale feature is discontinued, all materials shall be removed and become the property of the contractor. During removal, all sediment shall be disposed of, and the area restored to a finished condition as shown on the plans, or as directed by the Engineer.

**(B) Straw-Bale Check Dams:**

Check dam bales shall extend from the flow line into the cut or fill slopes. Rows of one or more bales on each side of the flow line shall overlap laterally at the flow line.

**(C) Straw-Bale Barriers:**

Unless otherwise shown on the plans, there shall be a minimum distance of six inches between straw bale barriers and the toe of cut and fill slopes.

**810-3.03 Riprap and Rock Mulch:**

Riprap used in cut and fill transitions; and rock mulch treatments for pipe inlets and outlets, headwalls and wingwalls, and rock check dams; shall be installed in accordance with the project plans and details or as directed by the Engineer.

Rock shall be installed so as to conform to and completely cover the treatment area shown on the plans with a uniform, cohesive rock unit. The rock shall not impede flow into the treatment area and shall be feathered at the outflow.

Accumulated debris shall be removed and disposed of by the contractor after each rain storm, or as directed by the Engineer.

Pipe treatments, headwall and wingwall treatments, and cut and fill transitions are permanent project features which shall remain in continuous service after installation and project completion.

Rock check dams shall remain in service until the seeding work commences or until they are no longer needed, as approved by the Engineer. When use of a rock check dam is discontinued, the materials shall be removed and wasted on site in a manner that will not impede designed drainage flows, as approved by the Engineer.

**810-3.04 Sand bags:**

The work shall include furnishing sand bags and sand, preparing the filled bags, and installing filled sand bags where shown on the plans or as approved by the Engineer.

Sand bags in the vicinity of curbs and catch basins shall be installed to two inches below the height of the adjacent curb to allow drainage into the catch basin. When sediment depth behind the sand bags reaches three inches, the sediment shall be removed and disposed of in accordance with local, state, and federal laws and permit requirements.

Sand bag features shall remain in service until disturbed areas have been stabilized, as directed by the Engineer.

When the use of a sand bag feature is discontinued, all materials shall be removed and become the property of the contractor. During removal, all sediment shall be disposed of, and the area restored to a finished condition as shown on the plans, or as directed by the Engineer.

**810-4 Method of Measurement:**

Silt Fence will be measured in accordance with Subsection 915-5.

Straw Bale check dams and barriers will be measured per each bale.

Pipe Inlet/Outlet Treatment, Headwall and Wingwall Treatment, and Rock Check Dams will be measured per cubic yard of rock mulch. Cut and Fill Transitions will be measured per cubic yard of riprap.

Sand bags will be measured per each filled sand bag placed into service.

**810-5 Basis of Payment:**

Silt Fence will be paid for in accordance with Subsection 915-6, except that no separate measurement and payment will be made for removal of sediment, the cost being considered a part of contract items.

The accepted quantities of straw bale check dams and barriers, measured as provided above, will be paid for at the contract unit price per each bale, which price shall be full compensation for the work, complete in place, including all excavation; preparation; and furnishing, installing, maintaining, final removal, and disposal of temporary straw bale check dams and barriers, including returning the area to a natural condition, as approved by the Engineer.

The accepted quantity of rock check dams, measured as provided above, will be paid for at the contract unit price per cubic yard of rock mulch, which price shall be full compensation for the work, complete in place, including all excavation; preparation; and furnishing, installing, maintaining, final removal, and disposal or dispersion, including returning the area to a natural condition, as approved by the Engineer.

The accepted quantity of Pipe Inlet/Outlet Treatment, measured as provided above, will be paid for at the contract unit price per cubic yard of rock mulch, which price shall be full compensation for the work, complete in place, including all excavation; preparation; and furnishing, installing, and maintaining of Pipe Inlet/Outlet Treatment, as approved by the Engineer.

The accepted quantity of Headwall and Wingwall Treatment, measured as provided above, will be paid for at the contract unit price per cubic yard of rock mulch, which price shall be full compensation for the work, complete in place, including all excavation; preparation; and

furnishing, installing, and maintaining of Headwall and Wingwall Treatment, as approved by the Engineer.

The accepted quantity of Cut and Fill Transitions, measured as provided above, will be paid for at the contract unit price per cubic yard of riprap, which price shall be full compensation for the work, complete in place, including all excavation; preparation; and furnishing, installing, and maintaining of Cut and Fill Transitions, as approved by the Engineer.

The accepted quantities of sand bags, measured as provided above, will be paid for at the contract unit price per each sand bag, which price shall be full compensation for the work, complete in place, including all excavation; preparation; and furnishing, installing, maintaining, final removal, and disposal of temporary sand bags, including returning the area to a natural condition, as approved by the Engineer. No separate measurement and payment will be made for removal of sediment, the cost being considered a part of contract items.

No additional measurement or payment will be made for temporary features subsequently designated by the Engineer as permanent, the cost being considered as included in the unit bid price.

No additional measurement or payment will be made for associated earthwork, ground preparation, stakes, silt and debris removal and disposal, or maintenance, the cost being considered as included in the unit bid price.